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A summary of progress in
mineralogy and petrography in 1890.

Geological Dept., Colby University.

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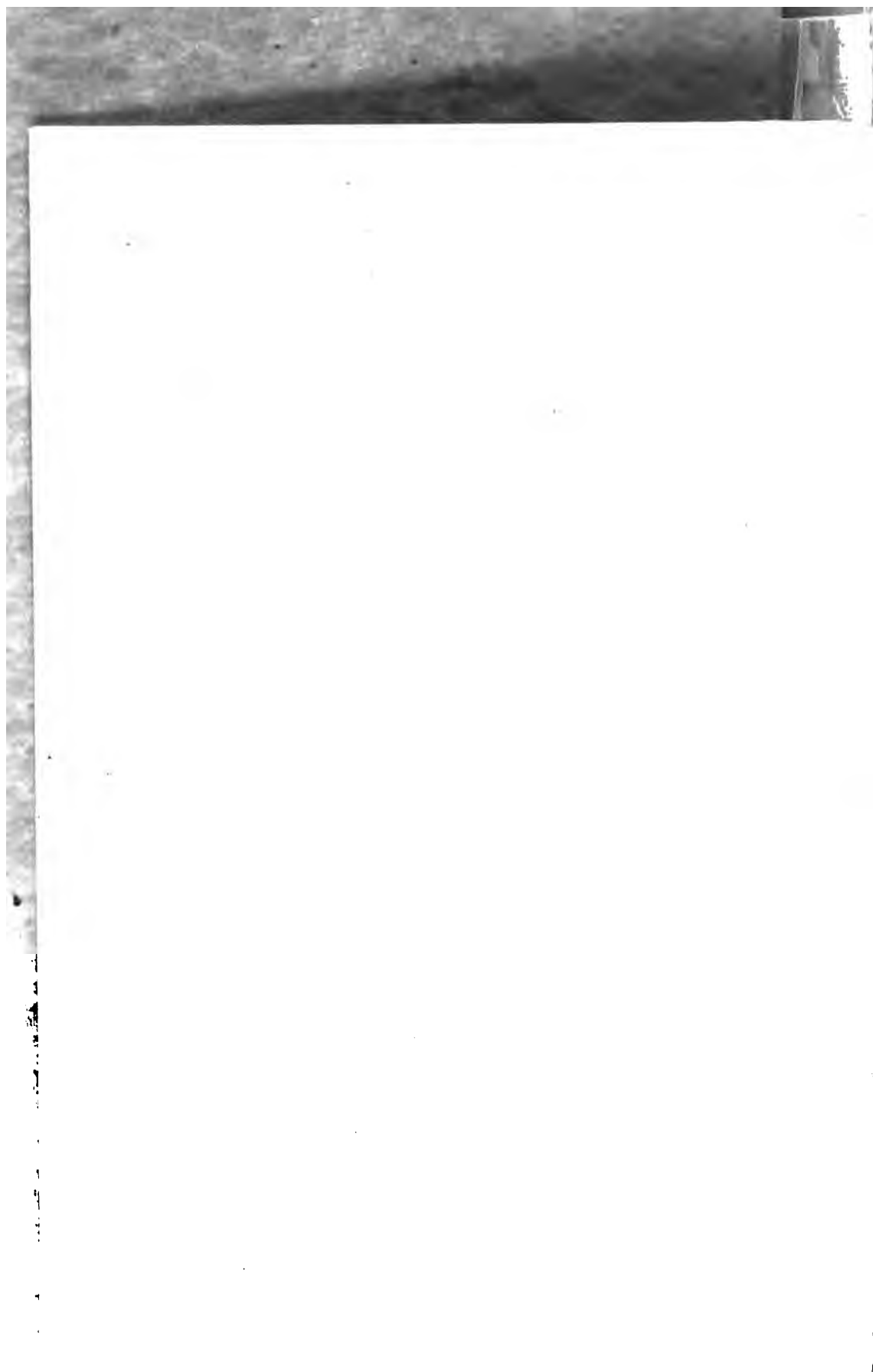
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From the AMERICAN NATURALIST, January, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—A most interesting rock is described by Osann² as forming the body of the hill known as Hoyazo, in the Spanish Province Almeria. The rock is an andesite consisting of a ground-mass of colorless glass containing small crystals of cordierite, flakes of biotite, lath-shaped microlites of plagioclase, and of an orthorhombic pyroxene, in which are porphyritic crystals of labradorite, a large quantity of biotite, columnar crystals of bronzite, hornblende, augite, and cordierite. The last-named mineral occurs in the form of irregular grains associated with quartz, and also in well-developed crystals, with a pleochroism: *A* = yellowish-white; *B* = dark violet; *C* = light violet. In the rock are inclusions of quartz, of aggregates of quartz and cordierite, and of a biotite gneiss rich in cordierite and garnet. A portion of the cordierite, separated from the rock, was analyzed with this result:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	Sp. Gr.
48.58	32.44	3.15	9.17	tr	6.03	2.625-2.628

The mineral is usually fresh, but contains numerous inclusions of sillimanite, whose composition is: Al₂O₃ = 63.52 %, SiO₂ = 35.43 %. The granular cordierite is supposed to represent the remains of foreign inclusions in which the mineral was an original constituent. The crystallized variety is thought to have arisen from the solution of a portion of the inclusions and a subsequent re-separation of cordierite, as well-developed crystals. The author regards the same explanation as applicable to all the cases in which cordierite has been found in volcanic rocks, *i.e.*, it is a secondary mineral produced by the solution of foreign inclusions in the magma of the eruptive.—Lacroix³ intends to make a complete study of pyroxene gneiss, and of rocks containing scapolite. He has published the first results of his work in a very excellent paper which is occupied with descriptions of the rocks of these two classes, together with the rocks associated with them as they are found in Brittany and in other parts of France, in Saxony, Austria, Spain, Algeria, Norway, Sweden, New York, Canada, Ceylon, India, and a few other places. As is to be expected, Lacroix finds many interesting facts connected with the structure, composition and genesis

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² *Zeits. d. deutsch. geol. Gesells.*, XL., 1888, p. 694.

Bull. Soc. Franc. d. Min., XII., 1889, p. 83.

of these two little-known rock groups. He has discovered that the scapolite rocks are sometimes the result of contact phenomena in marbles. Sometimes they are the result of the alteration of gabbros, and sometimes they are original. In every case it is found that there is a tendency of the rock to possess as constituents one or more rare rock-forming minerals. As the writer has examined all these very carefully, his paper is a mine of wealth to the petrographer who has to deal with rare minerals. Among the most interesting observations described may be mentioned the existence of dumortierite and cordierite in a gneiss from Bamle, Norway; fuchsite in a mica-schist from Salem, India; and the new mineral fouquéite in a gneiss from the same vicinity. Original epidote and parallel growths of this mineral with allanite in a pyroxene gneiss from Morbihan, France, and in a scapolite gneiss from Odegården, Norway, are described, as are also the regular arrangement of rutile needles in phlogopite and garnet and micropegmatitic intergrowths of pyroxene and quartz (page 297), pyroxene and oligoclase (pp. 316-318), garnet and quartz (p. 317), and amphibole and oligoclase (p. 319). The varieties of feldspar known as sun-stone and esmarkite are referred to, the properties of the minerals of the scapolite group are discussed, and the occurrence of secondary and original wollastonite and wernerite is mentioned. Contact rims consisting of hypersthene and amphibole, and tremolite and amphibole, are pictured around olivine in olivine-gabbros, and a rim consisting of biotite and amphibole is figured as seen around ilmenite. In addition to the observations made by Lacroix, there are incorporated in the paper descriptions of the facts discovered by earlier workers in the domain of these rocks. It therefore becomes a valuable compendium of our knowledge of scapolite rocks, so far as known. In connection with his description of the New York rock, Lacroix gives an interesting account of the properties of the minerals found in the neighborhood of Pierrepont.—Mr. J. P. Iddings⁴ has just published one of the most interesting papers that has yet appeared on the subject of lithophysæ. The article opens with a description of the macroscopic structure of the great mass of obsidian known as Obsidian Cliff, in the Yellowstone National Park. The most striking feature of the southern portion of the mass is its perfect columnar structure, with the columns all perpendicular to the surface over which the rock flowed. A petrographical description of the rock follows, and it is in this portion of his paper that the author shows well his ability to treat a complicated subject. Spherulites and lithophysæ are minutely

⁴ Seventh Ann. Rep. Direct. U. S. Geol. Survey, p. 255



described, and very fine pictures of the structures are given. Without being able to enter into a full discussion of the points so clearly brought out by Mr. Iddings, it is interesting to note that he regards the lithophysæ as having been produced, after the partial solidification of the rock in which they occur, by the expansion of the vapors imprisoned within the rock-mass before its eruption. The formation of the minerals coating the walls of the cavities was caused by the action of this water upon the materials of the rock. The expansion of the vapors was due to the diminution of the pressure under which they were confined in consequence of the upward bending of the rock layers above the places now occupied by the lithophysæ. These conclusions are in direct opposition to those of Szabo, Roth, Zirkel, and Cole,⁵ who regard lithophysæ as resulting from the alteration of spherulites.—A nephelinite composed of a granular aggregate of nepheline cementing porphyritic crystals of olivine, shreds of biotite, microlites of augite and magnetite, is announced by Levy and Callot⁶ as existing in a boss near Rougiers in Var, France.

New Minerals.—*Tephrowillemite*.—Dr. Koenig⁷ communicates the discovery of a brownish-gray, resinous, infusible substance at the Trotter Mine, Franklin, N. J. Only a portion of a single mineral was obtained, which yielded on analysis:

SiO₂ = 27.75, ZnO = 60.61, MnO = 10.04, Fe₂O₃ = 1.80, CaO tr.

It is a *manganese willemite* with the formula (ZnMnFe)₂SiO₄.—*Desaulesite*.—Associated with the above-described mineral, and also with *sphalerite*, *chloanthite*, *fluorite*, *apatite* and *nicolite*, beneath a stratum of yellow garnet, at a depth of 340 feet from the surface, is a greenish substance encrusting fluorite and filling cavities in it. In the closed tube it yields water and turns brown. It is infusible before the blow-pipe, but at this high temperature it regains its original color. Its composition is:

SiO ₂	NiO	ZnO	FeO	CaO	MgO	As ₂ O ₃	H ₂ O at 100°	H ₂ O at 600°
31.62	38.22	4.00	2.03	.70	.42	4.77	9.44	7.14

corresponding to NiZnFe(SiO₃) + 1½ Aq. It is therefore a *nickeliferous garnierite*.—*Yttrialite*.—From the gadolinite locality in Llano County, Texas, five miles south of Bluffton, Messrs. Hidden and Mackintosh⁸ have discovered a very large number of new and rare

⁵ AMER. NATURALIST, Jan., 1887, p. 70.

⁶ Comptes Rendus, 1889, p. 1124.

⁷ Proc. Acad. Nat. Sciences, Phila., Pt. II, 1889, p. 184.

⁸ Amer. Jour. Sci., Dec. 1889, p. 474.

yttria and thoria minerals associated with less rare compounds in the quartz veins cutting granite. Among the bodies new to mineralogy was found a yellowish substance in large masses with an olive-green color on a fresh fracture. Its specific gravity is 4.575, and its hardness 5-5.5. It is soluble in hydrochloric acid, decrepitates when heated, and breaks into an infusible and insoluble powder. Its composition is:

SiO ₂	PbO	ThO ₂	MnO	FeO	CaO	Al ₂ O ₃	Ce ₂ O ₃	Y ₂ O ₃	(LaDi) ₂ O ₃
29.17	.854	12.00	.77	2.89	.60	.55	1.86	46.50	2.94
UO ₃	Ign.								
.83	.79.								

—*Thorogummite* usually occurs in small pieces intimately associated with *fergusonite* and *cyrtolite*. It has a dull yellowish-brown color, a hardness of 4-4.5, and Sp. Gr. of 4.485. Occasionally groups of crystals with a ziron-like habit have been found. The mineral becomes of a dull greenish hue after ignition, and is soluble in nitric acid. Composition:

SiO ₂	UO ₃	ThO ₂	Al ₂ O ₃	Fe ₂ O ₃	(CeY) ₂ O ₃	PbO	CaO	H ₂ O	P ₂ O ₅	Ign
13.085	22.43	41.44	.965	.845	6.69	2.16	.41	7.88	1.19	1.23

corresponding to UO₃(ThOSi)₂, (OH)₁₂, or *gummite* in which the water has been replaced by thorite.—*Metagadolinite* is a grayish brown amorphous alteration product of gadolinite from the above mentioned locality. It has a red streak, a hardness of 3, and a specific weight of 3.494. Mr. Goldsmith⁹ has made an approximate analysis of it, and regards it as a new mineral.¹⁰ His result is:

SiO ₂	YO(?)	Ce ₂ O ₃ (?)	Fe ₂ O ₃	CaO	MgO	H ₂ O
18.145	21.854	20.662	26.026	3.642	2.14	9.761

—*Daviesite*.—Associated with other decomposition products of lead ores at Minas Beatriz, Sierra Gordo, Chili, Mr. Fletcher¹¹ discovered tiny, colorless, prismatic crystals of an orthorhombic mineral, with an axial ratio 1.2594 : 1 : .6018, and the plane of its optical axes parallel to ∞ P∞. From the few chemical tests made upon the small amount of material at his command, Fletcher supposes the mineral to be an oxychloride of lead.—*Dudgeonite*¹² was found at the Pibble Mine, near Creetown, Scotland, in little cavities occurring in *nickeline*. It is a grayish-white earthy substance, with a slightly resinous lustre. Its

⁹ *Proc. Acad. Nat. Sci. Phila.* Pt. II., 1889, p. 164.

¹⁰ Cf. F. A. Genth. *Amer. Jour. Sci.*, Sept. 1889, pp. 198-200.

¹¹ *Miner. Mag.*, VIII., May, 1889, p. 171.

¹² Heddle: *Miner. Mag.*, May, 1889, p. 200.



hardness is 3-3.5. In composition it corresponds to *annabergite*, with one-third of the nickel replaced by calcium ($\frac{2}{3}\text{NiO}$, $\frac{1}{3}\text{CaO}$), $\text{As}_2\text{O}_3 + 8\text{H}_2\text{O}$. [$\text{NiO}=25.01$, $\text{CoO}= .76$, $\text{CaO}=9.32$, $\text{As}_2\text{O}_3=39.33$, $\text{H}_2\text{O}=25.01$].—*Hydroplumbite* and *Plumbonacrite*.—The former mineral is in very small scaly crystals, with a pearly lustre, forming thin flakes of a pure white color, covering all the lead minerals of a specimen of associated lead ores, that probably came from Leadhills, Scotland. The amount of the new mineral obtained was too small for analysis; but from the synthesis of a similar substance, Heddle¹³ infers that its composition is $3\text{PbO H}_2\text{O}$. The second mineral (from Wanlockhead) resembles *hydroplumbite* in appearance, but yields upon analysis a result corresponding to the formula $\text{PbCO}_3 + 3\text{PbO H}_2\text{O}$ [$\text{PbO}=92.85$, $\text{CO}_2=4.76$, $\text{H}_2\text{O}=2.01$, residue= $.78$].—*Flinkite* is described by Hamberg¹⁴ from Pajsberg, Sweden. It occurs in greenish-brown tabular orthorhombic crystals, with a hardness of 4.5, and Sp. Gr = 3.87. Its composition is:

As_2O_3	Sb_2O_3	Mn_2O_3	Fe_2O_3	MnO	CaO	MgO	H_2O
29.1	2.5	20.2	1.5	35.8	.4	1.7	9.9

—*Fouqutite*.—In his excellent paper on scapolite rocks, Lacroix¹⁵ describes a dimorphous form of zoisite occurring as a constituent in an anorthite gneiss from the District of Salem, Madras, India. The new mineral is found in corroded and rounded monoclinic crystals, elongated in the direction of their c axes, and polysynthetically twinned with the orthopinacoid as the composition face of the various lamellæ. They possess a well-marked cleavage parallel to the face assumed as the basal plane, which makes an angle of 108° with $\infty\text{P}\infty$. The plane of their optical axes is oP , and the optical angle $2V$ is about 90° , with b as the positive acute bisectrix. The pleochroism is weak in yellow tints. The mineral is infusible before the blowpipe, and has a specific gravity of 3.24-3.31. It occurs in two varieties, the compositions of which are as follows:

	SiO_2	Al_2O_3	FeO	CaO	Loss.
Colorless:	36.6	32.5	1.9	23.9	2.7
Yellow:	38.3	31.9	4.4	23.5	2.7

—*Pleonektite* occurs with *arseniopleite* in the gangue of the manganese mine, Sjögrufvan, Grythyttan Parish, Örebro, Sweden. It is a light gray mineral,¹⁶ with a hardness of 4, and a metallic fatty lustre. It is

¹³ *Ib.*, p. 201.

¹⁴ *Geol. För. Förh.*, XI., 1889, p. 212.

¹⁵ *Bull. Soc. Franç de Min.*, 1889, p. 327.

¹⁶ *Ingelström: Neues Jahrb. f. Min.*, etc., 1889, II., p. 40.

transparent in thin splinters. Before the blowpipe it decrepitates, but does not fuse. On charcoal it gives the reactions for lead, antimony, arsenic, traces of manganese and water. It is probably a lead antimony arseniate resembling *hedyphane*.—*Anthocroite*.—When the ore from the Jakobsberg braunite mine is treated with hydrochloric acid, there is left as a residue a violet sand composed of little grains of a mineral that occurs scattered throughout the ore as well as throughout all the minerals associated with the ore, and in veins cutting the surrounding limestone. The largest masses of the mineral are in a magnese *vesuvianite*, and from this it can be obtained in a pure form. Lumps of the new mineral¹⁷ consist of small transparent grains of a light amethyst color, and a hardness of 5-6. It is biaxial, with an optical angle (in air) of about 100°. Its analysis shows it to be a bisilicate with the composition :

SiO ₂	MnO	CaO	MgO	Al ₂ O ₃ , Fe ₂ O ₃	K ₂ O, Na ₂ O
51.6	3.4	23.3	13.5	1.4	6.8

—*Michel-levyite* is the monoclinic form of barium sulphate, of which *barite* is the orthorhombic form. It was discovered by Lacroix¹⁸ in the crystallized limestone of Templeton, Canada. It is a flaky, white substance, with three cleavages. These are assumed as the three pinacoids, giving 77°-78° as the value of β . The plane of the optical axes is perpendicular to ∞P_{∞} , and the value of the optical angle is nearly 90°. The principal bisectrix probably coincides with the axis *b*. Specific gravity=4.39.—*Messelite* is found in aggregates of colorless or brown tabular crystals in a clay slate at Messel, a station on the railroad between Darmstadt and Aschaffenberg, Hessen. The crystals¹⁹ are monoclinic, with an extinction of 20° on the clinopinacoid. Their average percentage composition corresponds to the formula $(Ca Fe Mg)_3 (PO_4)_2 + 2\frac{1}{2}H_2O$.—*Wiluite* is the name given by *Prendel*²⁰ to a variety of *vesuvianite* from Wilui, Russia. Its composition is :

SiO ₂	TiO ₂	Al ₂ O ₃	CaO	MgO	Fe ₂ O ₃ , FeO	MnO	Alk	Loss
38.30	1.09	13.07	35.92	5.83	4.25	tr.	.37	.96

Crystals cut parallel to a prismatic face show the hour-glass structure in which the two constituent substances have different refractive indices. In sections parallel to the base the inner substances show a bi-

¹⁷ *Ib.*, p. 36.

¹⁸ *Comptes Rendus*, CVIII., 1889, p. 1126.

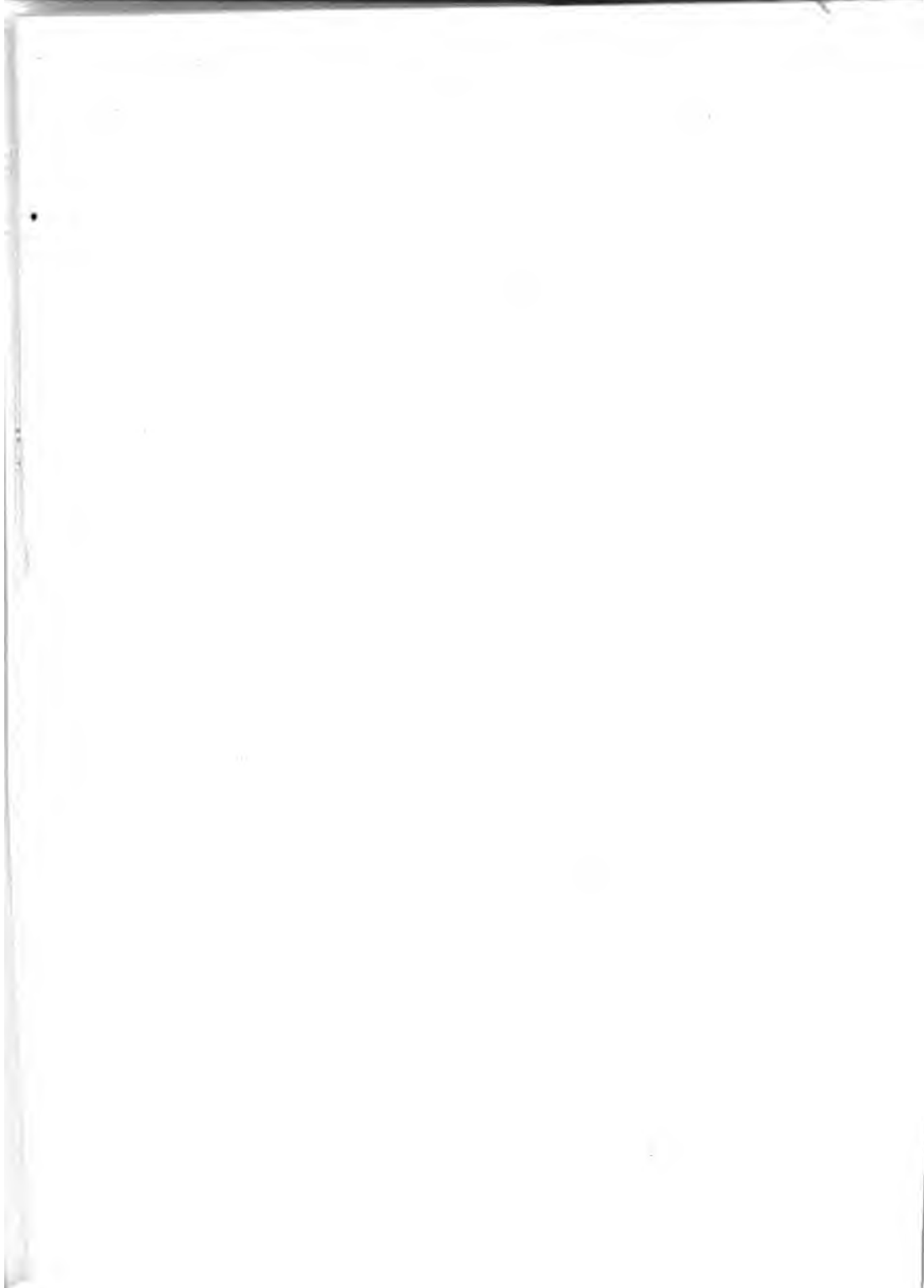
¹⁹ Muthman: *Zeits. f. Kryst.*, XVII., 1889, p. 93.

²⁰ *Ib.*, p. 94.



axial interference figure with an optical angle of 3° – 4° , while in the exterior zone the axial angle is 30° – 35° . In both substances the axial figure is decreased by heating. Their hardness is above .7, and their specific gravity, 3.331. Their conductivity for heat is greatest in the direction of the c axis.—Three new *cupro-descloizites* are described and analyzed by Hillebrand.²¹ The first occurs massive in the Mayflower Mine, Beaverhead county, Montana, in lumps of a dull yellow to pale orange color. The second is found as thick botryoidal incrustations in quartz, with a dull green color on the surface, and a brown color on a fresh fracture. It is found at the Lucky Cuss Mine, Tombstone, Arizona. The third came from the Commercial Mine, Georgetown, New Mexico, where it also is found as an incrustation on *quartz*. It varies in color from yellow through all shades of orange red to deep reddish-brown. The incrustations are distinctly crystalline, being made up of globular masses composed of little flat crystals crowded close together. At other times the incrustation is acicular in shape, when it appears to have formed on bunches of radiating *vanadinite* needles. The composition of this variety is :

PbO	CuO	FeO	ZnO	V ₂ O ₅	As ₂ O ₅	P ₂ O ₅	H ₂ O	Cl	SiO ₂	CaO	MgO
56.01	1.05	.07	17.73	20.44	.94	.26	2.45	.04	1.01	.04	.03





From the AMERICAN NATURALIST, February, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—In his report on the geology of the Rainy Lake region, Dr. Lawson² gives a petrographical description of the rocks comprising the Laurentian, Couthiching and Keewatin groups in the neighborhood of the above-named lake in Canada. The rocks of the Keewatin series are principally bedded traps and greenstones, altered from traps by metasomatic and dynamic metamorphism, and greenstones of clastic origin, hornblende schists and other foliated rocks. The effect of pressure is shown in the broken condition of many of the crystals in the rocks; crushed and sundered plagioclase, apatite, hornblende, leucoxene, tourmaline and quartz are all described and figured. Between the hornblende schists and the Laurentian gneisses the author recognizes phenomena which he believes to be due to contact action. If this supposition is found to be a correct one, the fact affords a striking confirmation of the view that the gneisses under the

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² Geol. and Nat. Hist. Surv. of Canada, Annual Report for 1887. Pt. F.

Keewatin are of eruptive origin. The Coutchiching series embraces mica-schists and other lighter colored schistose rocks between the lowest members of which and the gneisses are also evidences of contact action. Among the lighter schists are granulites and sericite-porphyrroids. In the Laurentian a hornblende-syenite gneiss occurs, and in it several pieces of twinned sphene were observed.—The two craters Mte. Cimino and the Lago di Vico³ in central Italy, though but parts of the same great volcano, like Mts. Somma and Vesuvius, have during their different periods erupted different kinds of lava. The lavas of Cimino have an andesitic habit. They are to be classed with the mica and augite andesites, the latter of which contain porphyritic sanidine and olivine. The younger crater, Lago di Vico, has poured forth leucite bearing rocks, of which leucitophyre, leucite-tephrite, leucite-basanite and phonolites are the prevalent types. A leucite-trachyte, placed by Rosenbusch among the phonolites, is the latest lava of the older crater. It is an intermediate type between the predominant lavas of Cimino and those of the later Lago di Vico. Besides the lavas, the former crater cast forth sanidnite bombs and calc-silicate bombs, containing garnets and vesuvianite.—In a brochure on the Obere Weilerthal, E. Cohen⁴ gives an interesting account of the eruptive and sedimentary rocks occurring in the Weilerthal south of the rocks made famous by Rosenbusch under the name Steigerschiefer. Those described by Cohen are granite, gneiss, quartzite-schists, phyllites, granite, porphyry, augite porphyry and minettes. In the granite is a brown hornblende in prismatic crystals. Their specific gravity varies between 3.082 and 3.140, and their composition is as follows:

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	Na ₂ O	H ₂ O
Darker var.	51.36	4.14	2.17	10.04	11.91	17.14	1.86	1.38
Lighter var.	51.82	4.17	2.34	9.84	12.18	17.18	1.34	1.13

Many of the other rocks described present interesting features, but none of great petrographical importance.—An examination⁵ of the northern slopes of Cader Idris, Merionethshire, Wales, discloses interbedded slates, tuffs, and massive eruptive rocks of considerable interest. Among the sedimentary rocks is the well-known pisolitic ironstone, in which the pisolitic structure is now represented by magnetite crystals in a cement of green iron silicate. This structure was originally pro-

³ W. Deecke, *Neues Jahrb. für Min.*, B. B. VI., 1889, p. 205.

⁴ Abh. zur Geol. Specialk. v. Elsass-Lothringen, B. III., H. III., p. 137.

⁵ *Quar. Journ. Geol. Soc.*, August, 1889, p. 432.



duced by the tendency of some carbonate to form concretionary masses around grains of sand or small shells. The original carbonate has for the most part disappeared, leaving the magnetite as a pseudomorph. Among the eruptives is a rock that the author calls eurite, following d'Aubuisson,⁶ although it would seem that the name quartz-keratophyre would sufficiently well characterize it. The rock is a bluish-gray compact substance with a specific gravity of 2.64. It contains quartz and feldspar crystals, wisps of biotite and spherulites of granophyre, more particularly around the porphyritic crystals, in a groundmass composed principally of a chloritic substance. Its analysis shows it to contain a soda-rich feldspar:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	Loss
72.79	13.79	3.32	tr.	1.94	.62	2.99	4.12	1.08

—In his description of the section Tanneberg of the geological map of Saxony, Dalmer⁷ mentions two rocks of some interest. The first is a sericite-gneiss, composed of quartz, plagioclase and sericite, with a breccia-like structure produced by pressure. The quartz and plagioclase are shattered, and the broken pieces are reunited by a cement of secondary quartz and sericite. The second is a chlorite-gneiss, consisting of orthoclase, albite, chlorite and quartz. This occurs in varieties of different degrees of coarseness. As it becomes finer in grain it loses feldspar, and assumes muscovite, until finally it approaches in structure and composition the phyllites of the region.—Kendall⁸ gives a list of the basic dykes on the island of Mull that contain the glassy selvages known as tachylite. It has been observed that the thickness of this glass band is always greatest in that portion of the dyke in contact with the most compact rock. A new type of tachylite, called by Groom⁹ carrockite, is associated with gabbro at Carrock Fell in the Lake District, England. It consists of a green glass enclosing spherules of quartz, feldspar, and granular aggregates of augite, and porphyritic crystals of the same minerals.—Prof. Bonney¹⁰ has examined certain banded micaceous schists from Morlaix, Brittany, which he thinks are the result of pressure and contact action. The rocks were originally stratified sands and muds, that were crumpled and foliated by pressure, and in which a light and a dark mica, chialtolite and andalusite were developed. By the subsequent intrusion of gran-

⁶ *Traité de Geognosie*, 1819, p. 117.

⁷ *Erl. z. Geol. Specialk. des Königr. Sachsen Blatt*, 64.,

⁸ *Geol. Mag.*, Dec., 1888, p. 555.

⁹ *Geol. Mag.*, Jan., 1889, p. 43.

¹⁰ *Quart. Jour. Geol. Soc.*, Feb., 1888, p. 11.

ite all traces of their fragmental origin were obliterated ; the rock became crystalline, and a few additional minerals were produced.—The first occurrence of glaucophane as a constituent of British rocks is noted by Blake¹¹ in an altered diorite from a quarry near the Anglesea Monument, Anglesea. The rocks consists of chloritized glaucophane, grains of epidote, a rutile quartz and calcite. The glaucophane is present in elongated prisms, which form a felt around epidote, and are included in the quartz.

Mineralogical News.—Morphological and Physical Properties.—

The possibility of the selection of half the planes of the monoclinic hemi-pyramid in such a way as to fulfill the conditions of hemihedrism has been shown by Williams.¹² If two of the planes intersecting in the plane of symmetry be allowed to develop to the exclusion of the other two, there results an apparent hemimorphism, which in reality satisfies all the conditions of hemihedrism. The monoclinic plane of symmetry remains, so that the character of the hemihedrism is the inclined-faced. Planes belonging to this hemihedral form are exhibited in pyroxene from Piedmont, Orange, and St. Lawrence counties, N. Y., and from Canaan, Conn. The habit is always hemimorphic.—In a recent paper Mügge¹³ records some interesting observations on parting planes in several minerals. He describes rutile from the Urals in which the usual cleavage parallel to $\infty P\infty$, is wanting, its place being taken by a parting parallel to $\frac{1}{2} P\infty$, but whether as a result of twinning or not, Mügge is unable to decide. The author thinks that this variety of rutile is identical with the mineral from Polk county, N. C., described by Des Cloizeaux¹⁴ as a dimorphous form of rutile. A garnet from Arendal, Norway, possesses cleavages parallel to the dodecahedral face, and contains acicular inclusions of cyanite with their $\infty P\infty$ faces parallel to the ∞O faces of the garnet, and their c axes parallel to the edges of these faces. The mineral occurs in a schistose dioritic rock whose hornblende constituent has a well-developed parting parallel to $P\infty$. Parting parallel to an octahedral face, in many members of the spinel group, is declared to be the result of polysynthetic twinning. Calcite, with a parting parallel to ∞P_2 , galena with twinning lamellæ parallel to $4O$, and breunerite, with $-2R\ 2R$ as the twinning plane, are also mentioned.—Boracite from

¹¹ *Geol. Mag.*, 1888, p. 125.

¹² *Amer Jour. Sci.*, Aug. 1889, p. 115. Cf. *AMER. NATURALIST*, Nov. 1887, p. 1025.

¹³ *Neues Jahrb. f. Min.*, etc., 1889, I., p. 231.

¹⁴ *Bull. Soc. franc., d. Min.*, IX., 1886, p. 184.



Lüneburg, Hanover, contains the new planes $\infty O\frac{1}{2}$, $\infty O\frac{1}{3}$, $\infty O\frac{1}{4}$ —Beginning with the Le Bel and Van t' Hoff theory with regard to the connection between the structure of the molecule (*i. e.*, the arrangement of the atoms within the molecule) and the activity of circularly polarizing substances, and applying the principles of this theory to the Sohacke-Wulff¹⁵ theory of crystal structure, Becke¹⁶ is forced to conclude that this theory of crystallization is not satisfactory, since it does not account sufficiently well for the close relation that exists between the crystallization of a body and its chemical nature. Becke thinks that the symmetry of crystals is intimately dependent upon the symmetry of arrangement of the atoms within the molecules. If this be true, all circularly polarizing bodies should possess an unsymmetrical molecule, which should reveal itself through the unsymmetrical character of its crystallization. Becke publishes a list of all the circularly polarizing substances known, and discusses in detail the crystallization of grape sugar, since this has been regarded as a triclinic substance, without evidence of hemimorphism or hemihedrism—the only two modes of crystallization that can yield enantiomorphous, *i. e.*, unsymmetrical figures. As a result of measurements of crystals of pure sugar, Becke concludes that it is monoclinic with $a : b : c = 1.735 : 1 : 1.908$. $\beta = 97^\circ 59'$, and hemimorphic in the direction of the c axis (really hemihedral, as indicated by Williams, *ref. above*). It is therefore enantiomorphous. The symmetry of its form corresponds with that of other circularly polarizing bodies, and corresponds also with the unsymmetrical structure of its chemical molecule, shown by recent synthetical methods. Two of these unsymmetrical molecules may be so arranged as to yield a crystal with one plane of symmetry (holohedrally developed monoclinic form), and four to produce forms with three planes of symmetry (orthorhombic forms). The symmetry of crystal forms thus depends primarily upon the distribution of the atoms within the molecule, Von Goldschmidt,¹⁷ carrying out this idea more fully, attempts to simplify the discussion of the chemical relations of the silicates by making certain assumptions with regard to the conditions necessary to the mixture of molecules in groups of isomorphous silicates. He regards the particles as the primary constituent of the molecule, just as the atoms are the constituent parts of the molecule. Chemistry he defines as relating to molecules and their composing atoms; crystallography as relating to crystals and their composing particles. Isomorphism is the

¹⁵ AMERICAN NATURALIST, 1889, p. 221.

¹⁶ Min. u. Petrog. Mitt., 1889, p. 464.

capacity of analogous particles to form similar crystals. Similar or analogous particles are those built on the same plan, though different in composition. Starting with these general ideas the author discusses the character of the particles forming the silicates, and concludes by applying his deductions to the explanation of the formulas of the most important silicates.——The examination¹⁸ of senarmontite crystals in thin sections parallel to the cubic, octahedral and dodecahedral faces, shows that the apparently simple crystals are combinations of six orthorhombic crystals, and that the optical anomalies so frequently observed in the mineral are due to this intergrowth, or to twinning. Unlike the double refraction of some other apparently regular minerals, the anomalous action of senarmontite is not in the least affected in a temperature as high as 360°.——Mügge¹⁹ has reinvestigated the subject of pressure twinning in sphene, and finds the twinning plane to be in the zone between ∞P and $-P$ (DesCloizeaux's position), and not to coincide exactly with $-2P$, as determined by Williams. He ascribes the striations frequently observed in the sphene of plutonic rocks to pressure, but is not able to produce them by artificial means.——As a result of measurements made in crystals of zinc obtained by slow distillation of the metal in a vacuum, Williams and Burton²¹ have calculated the axial ratio to be $a:c = 1:1.3564$. The crystals are hexagonal, with a probable rhombohedral symmetry, and isomorphous with arsenic, antimony, bismuth, and tellurium.——In the pyroxene from Pinzgauer, Cathrein²² has discovered the forms $\frac{3}{2}P_{\infty}$, P_4 , $\frac{1}{2}P_2$, all of which are new to the species. In amethyst from the Zillertal he has found the new planes

$$\frac{7}{8}R. + \frac{P_1P_2}{4} \text{ r. l.}, + \frac{2}{15}P_3^2 \text{ r.}, \text{ and } \frac{2}{5}P_7^2 \text{ l.}$$

while the forms most common to the mineral are absent.——The new plane $\frac{7}{8}P$ is recorded by Césaro²³ as occurring on topaz from Saxony.

Miscellaneous.—Retgers²⁴ has made a careful examination of the heavy solutions used for separating rock constituents with the endeavor

¹⁷ *Zeitschrift. für Min.*, XVII., p. 25.

¹⁸ Prendel, *Min. u. Petrog. Mitth.* XI., p. 7.

¹⁹ *Neues Jahrb. f. Min.*, etc., 1889, II., p. 89.

²¹ *Amer. Chem. Jour.*, XI., p. 219.

²² *Zeits. f. Kryst.*, XVII., 1889, p. 19.

²³ *Bull. Soc. Franc. de Min.*, XII., p. 419.

²⁴ *Neues Jahrb. f. Min.*, 1889, II., p. 185.



to obtain modifications with a specific gravity greater than 3.6. His investigations result in the discovery that methylene-iodide will dissolve iodine and iodoform, and yield a liquid with the density of 3.6. For separating minerals with a greater density than this, he suggests the use of fused silver nitrate. At 198° , this salt melts to a colorless liquid, with the density 4.1. A mixture of the nitrate and iodide of this metal give a yellow oily liquid at a temperature of 65° – 70° , whose specific gravity (5) is greater than that of any other substance, that has yet been proposed for the purpose desired. The author declares that these liquids serve as convenient means for separating the heavier minerals of rocks, and he gives directions for manipulating them.—The origin of most of the siliceous sinter deposited by the geysers in the Yellowstone Park is stated by Mr. Weed²⁵ to be due to a secretion of silica by algæ and mosses. Waters too poor in silica to form deposits of this substance by cooling or evaporation, are often dammed back by thick jelly-like accumulations of silica, separated from the water by plant life, which is quite abundant in some of the hot springs. The geyserites and similar bodies are produced by evaporation.

²⁵ *Amer. Jour. Sci.*, May, 1889, p. 351.





Extracted from the *AMERICAN NATURALIST*, April, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—The granite bosses of Morbihan, France, have suffered on their peripheries certain modifications which are ascribed by Barrois² to the rate of cooling. These modifications are endomorphous contact effects, but are in no way dependent upon the nature of the surrounding rocks. Two cases are recognized, according as the boundary lines of the bosses correspond with the strike of the enclosing strata or are perpendicular to it. In the first case, the granite, which is a muscovite-biotite rock, possesses on its periphery a zone of granite porphyry, with its phenocrysts arranged in fluidal lines. In the second case, the exterior modification is a fine-grained panidiomorphic aplite. Since the aplite and the porphyry both contain their constituents in idiomorphic grains, the author concludes that the crystallization of the magma yielding these and the granite has gone on progressively, the porphyritic rocks representing an intermediate stage in the formation of a granite from a magma. Schistose granites (gneisses) on the peripheries of these same bosses are aplites and porphyries that have been crushed by mechanical forces and then recemented by the deposition of secondary quartz. Since the gneisses are found only on the south sides of the bosses, the pressure to whose existence they are due is supposed to have come from that direction. —Mr. Iddings³ has continued⁴ his study of the cause of different structures in rocks produced from the same magma, and has published some of the results of his investigations on the igneous rocks of the Yellowstone Park. This study is concerned principally with the chemical relation of different rocks produced by the cooling of a single molten magma under different conditions. Electric Peak is a neck of diorite cut by numerous dykes of porphyrite. Separated from this by a great fault is Sepulchre Mountain, made up in large part of surface flows of the magma that was extruded through the orifice at Electric Peak. This magma under the conditions surrounding flows formed

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² Soc. Geol. du Nord., XV., 1887-8. p. 1.

³ Bull. Philos. Soc. of Wash., XI., p. 191.

⁴ *AMERICAN NATURALIST*, Dec., 1885, p. 1216, and Aug., 1889, p. 718.

pyroxene and hornblende andesites. The chemical composition of the group of plutonic rocks (represented at Electric Peak) and of the effusive group (at Sepulchre Mountain) is shown to be the same. The structure of their members and their mineral composition, however, are different, and these are shown by the author to be due to the different conditions under which the two groups solidified. The different mineralogical compositions of the various rocks belonging to the same group are likewise shown to be functions of the slight differences which occur in their geological environment. This affects the rate at which the heat escapes from the magma, and also the pressure which is experienced during its crystallization. These in turn affect the efficacy of the mineralizing agents held absorbed by the magma before its solidification. The mineralizing agents in turn show their effect upon the magma in the nature of the minerals separated from it.—Renard⁵ announces that the rocks of St. Thomas, in the Antilles, are diorites, containing phenocrysts of hornblende, and diabases. The former contain oligoclase, and the latter bytownite or anorthite. They are both much altered. The feldspar of the diorites has in most cases changed into epidote and quartz; that of the diabases into epidote, chlorite and calcite.—The same author⁶ describes the rocks of the island of Teneriffe as scoriaceous basalts, containing olivine and augite of the first consolidation. The very light color of the latter mineral and its well-marked polysynthetic twinning lamellæ cause it to resemble plagioclase. The lack of plagioclase places the rock in the group of the limburgites. The rocks from the crater of the Cañadas are also basalts, whose olivines are filled with muscovitic inclusions. Large crystals of andesine present in it have an undulous extinction. Augite andesites and trachytes containing sodalite, augite and sanidine with an undulous extinction are also described.—An interesting suite of analyses of some lower Silurian felsites from the southeast of Ireland enables Hatch⁷ to divide these rocks into potash, soda, and potash-soda felsites. The first group comprises felsites with few or no phenocrysts, while the second and third groups contain many porphyritic crystals of a striated feldspar in a cryptocrystalline aggregate of orthoclase and quartz. The phenocrysts may be albite or anorthoclase, while the feldspar of the ground-mass is orthoclase. The

⁵ Proc. Verb. Soc. Belg. d. Geol., II., 1888, p. 212.

⁶ Bull. Soc. Belg. d. Geol. Memoires, XII., 1888, p. 67.

⁷ *Geol. Magazine*, Dec., 1889, p. 545.

composition of the three groups may be represented by the following analyses :

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O	Na ₂ O	Loss	Sp. Gr.
(1)	70.8	15.1	1.0	.6	.2	1.1	9.1		1.6	2.606
(2)	71.2	16.8	.8	1.5	.8	.9	2.1	4.7	1.5	2.606
(3)	70.6	15.3	.7	1.7	.8	.8	6.1	2.7	.9	2.645

—Wethered⁸ has examined the Jurassic pisolite of Cheltenham, England, and has discovered to his surprise that its structure is not concretionary, but that it is of organic origin. The spherules show a nucleus, surrounded by numerous concentric layers of innumerable minute tubuli, produced by an organism similar to *Girvanella*.—The Kentish Rag, from near Maidstone, Eng., contains a large proportion of calcium sulphide, as shown by an analysis made by Mr. Sanford:⁹

SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	P ₂ O ₅	CaO	MgO	Alk.	CO ₂	SO ₂	CaS	Aq
72.051	2.15	.055	12.523	.054	.122	9.984	.647	1.334	.995	

—Some of the peculiarities of the numerous dykes cutting the slates and granite in the neighborhood of Kennebunkport, Maine, are mentioned by Mr. Kemp.¹⁰ The rocks forming the dykes are granites, diabases, camptonites, and diabase porphyrites.

New Minerals. — *Redingtonite*, *knoxvillite*, *metastibuite* and *nopalite*.—At the hundred and fifty foot level of the Redington Mine, in the Knoxville District, California, is a hydrous chromium sulphate, supposed to be the result of the action of solfataric gases upon chromic iron. The mineral occurs as a finely fibrous mass of a pale purple color, that becomes colorless in the thin section. The fibres are doubly refractive, and have an extinction varying between 13° and 38°. When heated, the mineral turns green without losing all of its water, and then agrees in most of its properties with *copiapite*. The green sulphate consists of rhombic tables with angles of 78° and 120°. They have good cleavages parallel to the base, the prismatic faces and the macropinacoid. The absorption is greatest when the short diagonal of the crystals corresponds with the principal plane of the nicol. The axes of elasticity lie in the oP face—the one parallel to the brachy-axis being the greater. Mr. Becker¹¹ calls the purple mineral *redingtonite* and the green one

⁸ *Geol. Magazine*, May, 1889, p. 197.

⁹ *Ib.*, Feb., 1889, p. 73.

¹⁰ *Amer. Geologist*, Mar., 1890, p. 129.

¹¹ G. F. Becker: *Geology of the Quicksilver Deposits of the Pacific Slope*. Monographs XIII. Washington, 1888, p. 343.

knoxvillite. A brick-red sulphide of antimony from the filling of a vein in a sinter deposit in the Steamboat Springs District, near the Comstock Lode, Nevada, is named *metastibnite* by the same author. *Napalite*¹² is a dark reddish-brown substance of the consistency of shoemaker's wax occurring at the Phoenix Quicksilver Mine, Pope Valley, California. Its hardness is 2, and specific gravity 1.02. It is brittle. It fuses at 42°–46°, and boils at 300°. When first taken from the ground it is green by reflected light, and garnet by transmitted light. Upon exposure it loses its green fluorescence. The composition of the mineral is supposed to be near C_3H_4 . — *Nesquehonite*¹³ is an alteration product of *lansfordite*, the new magnesium compound described by Genth¹⁴ a few months ago. The latter mineral, upon exposure, rapidly changes over into prismatic, orthorhombic crystals, usually arranged in radiating groups. Their axial ratio is $a:b:c = .645:1:.4568$. OP is the plane of the optical axes. The brachy-axis is the acute bisectrix, which is negative. The optical angle $2V_{aa} = 53^\circ 5'$. Hardness = 2.5, and Sp. Gr. = 1.83. The composition of the substance corresponds to $MgCO_3 + 3H_2O$ [$CO_2 = 30.22$; $MgO = 29.22$, $H_2O = 40.32$]. Artificial nesquehonite has been prepared by allowing aqueous solutions of magnesium carbonate containing carbon dioxide to stand undisturbed for some time. The crystals thus obtained present the same features as the natural product. Measurements of the indices of refraction on one of these crystals gave: $\alpha = 1.495$, $\beta = 1.501$, $\gamma = 1.526$. Perfect pseudomorphs of nesquehonite after lansfordite (incrustations and stalactites) were found at the locality from which the latter mineral has been described—Lansford, Schuylkill Co., Pa. — *Natrophilite* is a new member of the triphylite group lately described by Messrs. Brush and Dana¹⁵ from Branchville, Connecticut. The mineral is usually found in masses with a good cleavage, although occasionally grains with an indistinct crystal form are detected. It resembles very closely the lithiophilite ($LiMnPO_4$) discovered by the same authors some time ago, in both its morphological and optical aspects. Its color, however, is a deep wine, resembling the tint of Brazilian topaz. Its most characteristic features are its very brilliant lustre and its easy alteration into a pale yellow, silky, fibrous substance that covers all its surfaces and

¹² Becker: *Ib.*, p. 372.

¹³ Genth and Penfield: *Amer. Jour. Sci.*, Feb., 1890, p. 121.

¹⁴ AMERICAN NATURALIST, April, 1889, p. 261.

¹⁵ *Amer. Jour. Sci.*, March, 1890, p. 205.

penetrates its mass. The composition of natrophilite, as determined by Mr. H. L. Wells, is:

P ₂ O ₅	MnO	FeO	Na ₂ O	Li ₂ O	H ₂ O	Loss
41.03	38.19	3.06	16.79	.19	.43	.81,

essentially NaMnPO₄. The new mineral is regarded as but another one of the very interesting substances produced by the alteration of *spodumene* and *lithiophilite*. The *triphylite* group as now known consists of triphylite (LiFePO₄), lithiophilite (LiMnPO₄), and natrophilite (NaMnPO₄), besides many intermediate compounds.—*Rosenbuschite*, *nordenskjöldite*, and *melanocerite* have been described by Brögger¹⁶ from the syenite dykes in the vicinity of the Langesundsfjord, in Southern Norway. The first mineral is found in radial groups composed of monoclinic fibres with cleavages parallel to oP , $\infty P\infty$ and $2P\infty$. The axial ratio is $a:b:c = 1.1687:1:.9775$. $\beta = 101^\circ 47'$. The acute bisectrix is b . The obtuse bisectrix is inclined 36° to c in the acute angle β . Double refraction strong. The mineral is easily fusible, and is decomposed with strong hydrochloric acid. It is light orange gray in color, and is weakly pleochroic with $C > B > A$. Its specific gravity is 3.31 and hardness 5–6. In morphological properties and in composition it is apparently a zirconium *pectolite*.

SiO ₂	ZrO ₂	TiO ₂	Ti ₂ O ₃	Fe ₂ O ₃	La ₂ O ₃	(DiCE) ₂ O ₃	MnO	CaO	Na ₂ O	Loss
31.53	18.69	6.07	1.31	1.15		2.38	1.85	25.38	10.15	.20

—*Nordenskjöldite* is a calcium-tin-borate with the composition [Ca Sn (BO₃)₂]:

SnO ₂	ZrO ₂	CaO	B ₂ O ₃	Loss
53.75	.90	20.45	23.18	1.72

It crystallizes rhombohedrally with $a:c = 1:1.8221$, and is tabular in habit. It is sulphur yellow in color, is transparent, optically negative and strongly doubly refractive. Its hardness is $5\frac{1}{2}$ –6 and Sp. Gr. 4.2. *Melanocerite* is also rhombohedral with $a:c = 1:1.2554$. It occurs in tabular crystals of a deep brown or black color. Their double refraction is negative, hardness 5–6, and specific gravity 4.129. Chemically the mineral is a complicated compound of the rare earths with silica, tantalum, boron, and fluorine.—*Cohenite* is described by Weinschenck¹⁷ from the meteoric iron of Magura, Hungary. When dissolved in hydrochloric acid the meteor leaves a residue in which little prismatic tin white crystals are discovered. These turn brown when

¹⁶ Geol. För. i. Stockholm Förh., IX., 1887, p. 247. Ref. Neues Jahrb. f. Min., etc., 1889, II., p. 432.

¹⁷ Ann. K. K. Naturh. Hofmus., Wien., IV., 1889, p. 94.

exposed to the air. They are highly magnetic, are brittle, have a hardness of 5.5–6, and a specific gravity of 6.977. When analyzed they yield Fe = 90.19; Ni = 3.08; Co = .61; C = 6.70; P = .08; and traces of Cu and Sn—a composition corresponding to the carbide of iron and nickel $(55\text{Fe. } 2\text{NiCo})_3\text{C}$.—In addition to the organic compound napalite, referred to above, two others have lately been described; one by Blake¹⁸ from the Uintah Mountains in Wahsatch County, Utah, to which he has given the name *wurtzilite*, and the other by Morrison¹⁹ from the old red sandstone at Craig Well, near Dingwall. The latter is a mineral tar, associated with *albertite*. It is called *elaterite*. Its composition as found by Macadam is C = 81.186; H = 13.372; O., etc., = .4453; N = .127; S. = .862. *Wurtzilite* is a firm, black, solid substance resembling jet. It is found in large, pure, amorphous masses a little heavier than water, and elastic in thin flakes. In thin pieces it is garnet red. Its hardness is 2–3, and specific gravity 1.03. It does not fuse in boiling water, but melts readily in the flame of a candle, when it burns with little smoke. It does not dissolve easily in any of the usual reagents.—Two new minerals to which names have not yet been given by their discoverers have been described respectively by Sjögren²⁰ and Ussing²¹. Sjögren's mineral occurs in vitreous, transparent, light green tables, associated with *synadelphite*, at the mine Ostra, in Nordmark, Sweden. The tables possess an easy cleavage and a pearly lustre. They are biaxial, with the plane of their optical axes nearly normal to the cleavage plane. The axial angle is small. Before the blowpipe the mineral blackens and fuses with difficulty. In the air it oxidizes and becomes dirty gray or brown. A qualitative examination shows the presence of As, Mn, Zn, and Fe. Ussing's compound is found imbedded in microcline, and associated with aegerine and lithium mica. It forms, small, thick rhombohedral crystals, with $a:c = 1:2.1422$. The principal forms present are $0R$, $\frac{1}{2}R$, $\frac{1}{4}R$, R , ∞R , $-2R$, $-\frac{1}{2}R$ and ∞P_2 . The faces are sometimes brilliant, and at others dull. The crystals are yellowish-brown and translucent. They are optically uniaxial and positive. Their specific gravity is 2.07, and hardness 5. In form, they resemble *eudyalite*. Their locality is Kangerdluarsuk, Greenland.

¹⁸ *Eng. and Min. Jour.*, December 21, 1889.

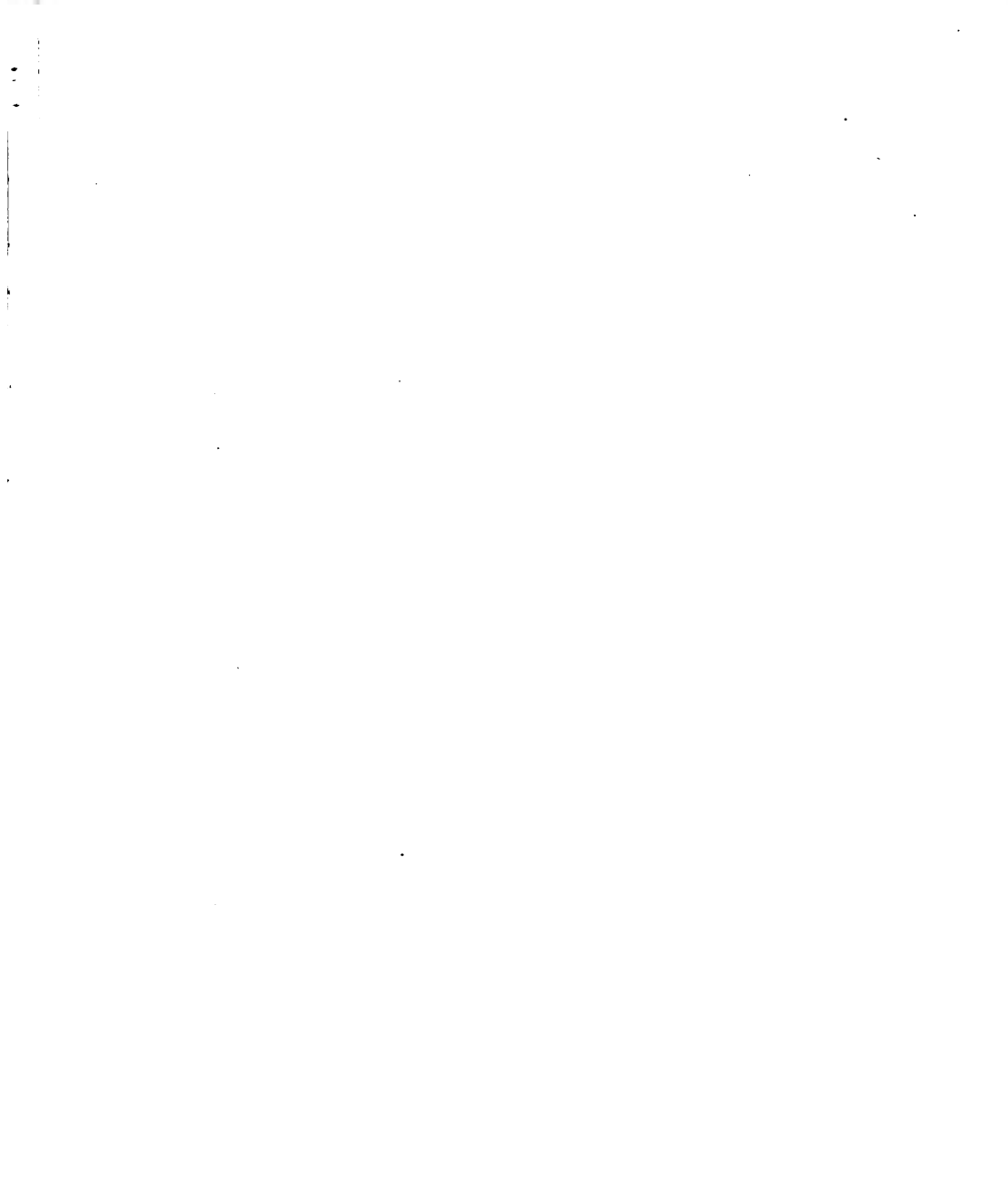
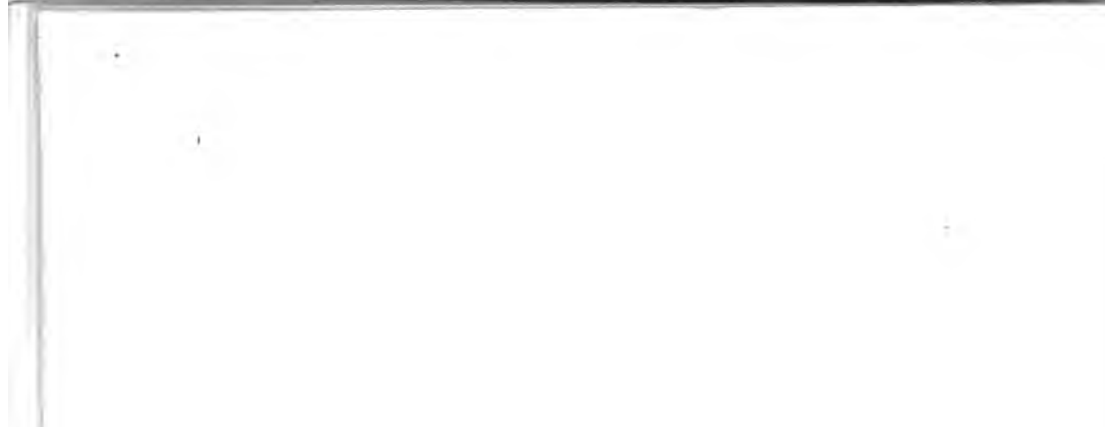
¹⁹ *Min. Mag.*, March, 1889, p. 133.

²⁰ *Ofversigt af Kongl. Vetenskaps-Ak. Förh.*, Stockholm, 1888, p. 561. Ref. *Neues Jahrb. f. Min., etc.*, 1890, I., p. 24.

²¹ *Geol. Fören. Förh.*, X., p. 190, Stockholm. Ref. *Neues Jahrb. f. Min., etc.*, 1890, I. p. 25.



Miscellaneous.—Perlitic structure, according to Mr. Chapman,²³ may be produced in Canada balsam by heating this substance until it is thick enough to become brittle when cold, and then pouring it upon a roughened glass plate and suddenly immersing in cold water.—Harker²³ ascribes the eyes of pyrite in slate to the displacement of the matrix around pyrite crystals through pressure. Because of its hardness the pyrite resists the pressure. The slate yielding to it breaks away from the crystal along a plane perpendicular to the line of force, and leaves little hollows on both sides of it. The hollows are afterwards filled with quartz. The eyes consist of pyrite, forming a center, imbedded in a lenticular mass of quartz or some other secretory mineral.—In a book of about two hundred and seventy pages Mr. Merrill²⁴ publishes a catalogue of the building stones in the collection of the National Museum, and gives a very clear and succinct account of the methods employed in quarrying and finishing the various rocks used in construction.—A very valuable account of the mineral resources of Michigan is given by Mr. Lawton²⁵ in his annual report as Commissioner of Mineral Statistics of Michigan.—Dick²⁶ describes a new form of binocular microscope for use in petrographical investigations, made according to his own design. The most important new feature of the instrument is the connection of the two nicols, which may be made to revolve together or separately, at the will of the manipulator.





From the AMERICAN NATURALIST, June, 1890.

MINERALOGY AND PETROGRAPHY¹

Mineralogical News.—The long expected monograph by Brögger² on the minerals of the syenite-pegmatite veins of the augite syenite and nepheline syenite region of Southern Norway has at last made its appearance. The special part of the volume, which describes in great detail seventy mineral species, is prefixed by an introduction of 235 pages, in which the geology of the region is discussed and the eruptive nature of the pegmatite veins is proved. An abstract of this portion of the work will be given in another place. Of the seventy mineral species recognized in the veins five are of sulphides, one is a sulpho-salt, three are oxides, three are hydroxides, one is a haloid compound, one a ferrate, two are borates, two phosphates, two are members of the zircon group, three belong to the epidote group, two to the group of the datholites, three to the garnets, three to the micas, two to the nepheline group, two to the leucophanes, seven to the pyroxenes, four to the hornblendes, four are members of the melanocerite group, three are feldspars, seven are zeolites, and nine others are various silicates. The only carbonate detected, beside two fluo-carbonates, is calcite. It is evidently impossible to mention even all of the important discoveries made by the author in his studies of the wonderful suite of specimens collected by him. We can only refer briefly to the most important of them. Measurements of *töllingite* yielded $a : b : c = 6689 : 1 : 1.2331$. Tabular crystals of *hydrargillite* gave $a : b : c = 1.7089 : 1 : 1.9184$; $\beta = 85^\circ 29' 10''$. These are occasionally un-twinned, but more frequently twinned forms are found in which the twinning planes are ∞P (corresponding to DesCloizeaux twins par. $\infty P \infty$), $\infty P \infty$ (occasionally), $\frac{1}{2} P \frac{1}{2}$ (?), and oP ; and a fifth form in which the twinning plane is perpendicular to oP . Optically, plates of the mineral act uniaxially. *Xenotime*, while containing many elements, yielded upon analysis figures that may be reduced to correspond to the formula $Y_2(PO_4)_3$. An examination of thin sections of *orthite* (*allanite*) shows its extinction in $\infty P \infty$ to vary between $37\frac{1}{2}^\circ$ and $28\frac{1}{2}^\circ$ in acute β . The plane of the optical axes is perpendicular to $\infty P \infty$, and the double refraction is negative. Analysis of carefully purified *homillite* gave:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Ce ₂ O ₃	B ₂ O ₃	FeO	CaO	Na ₂ O	H ₂ O
31.83	2.72	.88	.24	16.51	16.74	29.54	.75	.79

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² *Zeits. f. Krystall.*, XVI. Specialler Theil, 664 pp., XXVII. Pl.

Single crystals are described, and twins following four twinning laws are well illustrated in the plates. The optical properties of the mineral are briefly sketched. Several varieties of *garnet* are mentioned, two analyses of which are worth recording. The black-green garnet of Stokö and the yttrium garnet of the same locality contain respectively:

SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Mn ₂ O ₃	Y ₂ O ₃	MnO	MgO	CaO	Na ₂ O	H ₂ O
34.90		8.97	20.43			2.40	tr.	31.38		1.27
31.51	3.52	2.01	26.68	2.15	.38		.38	30.78	.79	.43

Nordenskjöldite, with an axial ratio of $a : c = 1 : .8221$, has a composition corresponding to $\text{Ca}(\text{BO})_2\text{SnO}_4$. *Astrophyllite*, as the result of new measurements, is concluded to be orthorhombic with $a : b : c = 1.0098 : 1 : 4.7556$. Its fracture figure (on the perfect cleavage parallel to $\infty P \infty$) consists of two lines crossing each other at angles of about 81° and 98° , the smaller of which is bisected by the vertical axis. The gliding planes correspond very nearly to those of the dome $\frac{1}{4} P \infty$. The axial plane is the base, with b the positive acute bisectrix. A new analysis of carefully purified material shows slight differences from the previously published analyses, and corresponds closely to the formula $\text{R}_4'' \text{R}_4' \text{Ti}(\text{SiO}_4)_4$. *Leucophane* crystals to the number of twenty gave good enough reflections to enable Brögger to determine without difficulty their orthorhombic symmetry, $a : b : c = .9939 : 1 : .6722$. The axial plane is the macropinacoid and c is the negative acute bisectrix. $2E_{\text{Na}} = 74^\circ 15'$. *Melinophane* crystallizes in the tetartohedral division of the tetragonal system. Optically it is uniaxial. Chemically it differs from leucophane [$\text{Na}_2(\text{FBe})_2\text{Ca}_2(\text{SiO}_4)_4$] in containing more beryllium [i. e. it is $\text{Na}_2(\text{FBe})_2(\text{Ca}_2\text{O})_2\text{Be}_2(\text{SiO}_4)_4$]. A thorough discussion of the characteristics of *acmite* and *ægerine* leads to the view that they are well marked varieties of the same pyroxene, closely related to diopside. Acmite is nearly always twinned, while ægerine is usually in simple crystals. *Låvenite* according to the most recent measurements has $a : b : c = 1.0963 : 1 : .7151$ and $\beta = 69^\circ 42\frac{1}{2}'$. *Wöhlerite* usually occurs in twins, whose twinning plane is the orthopinacoid. When placed in the conventional position for pyroxene its axial ratio becomes $a : b : c = .9966 : 1 : .3547$ with $\beta = 89^\circ 18' 50''$. Its absorption is $C > B = A$, and pleochroism varies between yellow and colorless shades. *Låvenite* and *Wöhlerite* are regarded as zirconium pyroxenes, closely related to the corresponding triclinic pyroxene *hiortdahlite*. *Polymignite* crystals are orthorhombic, as is well known, with the axial ratio $.7121 : 1 : .5121$. Their hardness is 6–6.5, and density 4.77–4.85. Chemically and morphologically the mineral is



closely related to *æschynite*, with which it forms a group distinct from all other natural mineralogical groups. When placed in a position corresponding to the usual one for *æschynite* its axial ratio becomes $a : b : c = .4681 : 1 : .7192$. Measurements of the best *arfvedsonite* crystals gave $.5496 : 1 : .2975$ as the axial ratio for this species, with $\beta = 75^\circ 44\frac{1}{2}'$. The analysis of a large crystal yielded (after treating with acid to dissolve magnetite) :

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	Na ₂ O	K ₂ O	H ₂ O
49.90	2.62	32.99	.05	.57	12.88	.10	1.07

Pterolite is regarded as an alteration product of *barkevikite*, consisting of a mixture of *lepidomelane* and *ægerine*, and *ainigmatite* is thought to be identical with *cosyrite*. An optical examination of *katapleite* proves it to be monoclinic with $a : b : c = 1.7329 : 1 : 1.3618$ and $\beta = 89^\circ 48\frac{1}{2}'$, and not hexagonal as formerly supposed, although it assumes the hexagonal symmetry when heated to 140° . Two varieties of the mineral are recognized. The first is a yellow variety to which the name *katapleite* is assigned, and the second a blue variety which is called *soda-katapleite*. The composition of the varieties is given as follows :

	SiO ₂	ZrO ₂	Al ₂ O ₃	FeO	CaO	Na ₂ O	H ₂ O
I	41.56	32.53	1.02		5.21	9.74	9.35
II	44.04	30.94		.10	.87	14.94	9.24

Tritonite, according to Brögger, does not crystallize in the regular system, but is probably rhombohedral and hemimorphic. In this case $a : c = 1 : 1.114$. The analyses that have been published as those of *Erdmannite* are thought to be analyses of a mixture of a melanocerite mineral with a member of the *homilite* group. *Eukotite-titanite* is a deep brown variety of *sphene*, with most of the optical and crystallographic properties of this mineral, but differing from it slightly in composition, which is as follows :

SiO ₂	ZrO ₂	TiO ₂	CeO ₂	Ce ₂ O ₃	Y ₂ O ₃	CaO	FeO	MgO	Na ₂ O	K ₂ O	Loss
30.22	.18	34.78	2.57		.59	24.38	3.84	.50	.86	.27	.31

The *soda-orthoclase* of *Fredriksvärn* turns out upon close examination to be an intergrowth of such fine lamellæ of *albite* and *orthoclase*, that upon examination with low powers of the microscope, a section of this mineral behaves as if monoclinic. Brögger calls it *cryptoperthite*. *Eudidymite* has been carefully examined and its properties well established. It is a monoclinic mineral, resembling in appearance *heulandite*. Its axial ratio is $a : b : c = 1.7107 : 1 : 1.1071$, and $\beta = 86^\circ$

27". It occurs in tabular crystals, with a perfect cleavage parallel to the base; a hardness of 6 and a specific gravity of 2.553. The extinction in $\infty P\infty$ is inclined $58\frac{1}{2}^\circ$ to c and $27^\circ 45'$ to the cleavage parallel to oP . $2V_a = 29^\circ 55'$ for sodium light. Very exact measurements of a large number of *natrolite* crystals from Little—ar ∞ indicate that the mineral is monoclinic with $a : b : c = 1.0165 : 1 : 1.3599$, and $\beta = 89^\circ 54' 52''$, and not orthorhombic as is usually assumed. The orthorhombic symmetry, which is ordinarily observed, is due to twinning parallel to the orthopinacoid. These monoclinic natrolites differ from the ordinary orthorhombic form in containing a small quantity of potassium. The extinction angle increases with the potassium content. *Bergmannite* and *brevicite* are shown by the author to be either natrolite, or mixtures of this mineral with several other substances.

New Minerals.—*Hambergite*. A single specimen of this mineral is of grayish white color, and is orthorhombic with ∞P , $\infty P\infty$, $\infty P\infty$ and ∞P . $a : b : c = .7988 : .7267$, and hardness = 7.5. Sp. Gr. = 2.347. Plane of the optical axes is ∞P , ∞ and c is the acute bisectrix. $2Vna = 87^\circ 7'$ (observed) or $87^\circ 40'$ (calc.). Analyses yielded: $BeO = 53.25\%$; $H_2O = 10.03$; $B_2O_3 = 36.72$; $=(HO) Be_2B_3O_{11}$. — *Johnstrupite* was originally confused by Brogger with mosandrite, which it resembles in many respects. Careful observation shows its axial ratio to be $a : b : c = 1.6229 : 1 : 1.3594$. $\beta = 86^\circ 55\frac{1}{2}'$, and the plane of its optical axis the clinopinacoid, with the positive acute bisectrix inclined $2\frac{1}{2}^\circ$ to c , in which it closely resembles mosandrite. The latter mineral however is reddish brown when fresh, while johnstrupite is brownish green. That they are two distinct minerals is shown by their composition, which corresponds respectively with the formulas $(OH)_6F_2H_{11}R_4Na_2Ca_{10}Ce_2(SiO_4)_{11}$ for mosandrite, and $F_2H_2R_4Na_6Ca_{11}Ce_2MgAl(SiO_4)_{11}$ for johnstrupite. The similarity in composition and morphological properties between these two minerals and epidote leads the author to regard them as members of same group. — *Calciorthorite* is a deep reddish brown amorphous substance, with a hardness of 4.5 and a sp. gr. of 4.114. Its composition is:

SiO ₂	ThO ₂	Ce ₂ O ₃	Y ₂ O ₃	Al ₂ O ₃	Mn ₂ O ₃	CaO	MgO	Na ₂ O	H ₂ O
21.09	59.35	.39	.23	1.02	.73	6.93	.04	.67	9.39,

corresponding to $5ThSiO_4$, $2[Ca_2SiO_4] + ca. 10H_2O$. — *Hiortdahlite* is a triclinic pyroxene occurring in small, thin, tabular crystals of a yellowish or yellowish brown color. Its crystallographic constants are $a : b : c = .9981 : 1 : .3537$, $\alpha = 89^\circ 30' 57''$, $\beta = 90^\circ 29' 6''$, $\gamma = 90^\circ 6' 10''$. The crystals are elongated in the direction of the



vertical axis, and are flattened in the direction of the macropinacoid. Like wöhlerite, nearly all horthohite crystals are twinned. In the latter case the twinning plane is at right angles to the vertical axis, and the combination face is the macropinacoid. The axial angle is large. The optically positive first bisectrix is sharply inclined to the vertical axes. The extinction on the $\infty P\bar{\infty}$ is 25° and on $\infty P\bar{\infty}$ is about $15\frac{1}{2}^\circ$. No well marked cleavages are observed in any sections. The specific gravity is 3.235—3.267, and the composition :

SiO ₂	TiO ₂	ZrO	ZrF ₂ O	Fe ₂ O ₃	FeO	MnO	CaO	MgO	Na ₂ O	H ₂ O
31.89	1.50	2.88	22.00	.34	.94	.96	32.53	.10	6.53	.58

—*Cappellinite*, the discovery of which was announced some years ago by Brogger, occurs in hexagonal prisms with ∞P , $\frac{1}{2} P$ and P . $a : c : \epsilon : \epsilon$: 1 : 1.9903. Their double refraction is negative and their composition is as follows :

SiO ₂	B ₂ O ₃	Y ₂ O ₃	La ₂ O ₃	CeO ₂	ThO ₂	BaO	CaO	Na ₂ O	K ₂ O	Loss
14.66	16.98	52.62	2.97	1.29	.80	8.29	.67	.53	.22	.61,

corresponding to the molecular combination of $R_2^{IV}(\text{SiO}_3)_2$ and $R^{IV}(\text{BO}_3)_2$. The hardness of the mineral is 6, and its specific gravity is 4.407. It is regarded as a member of the melanocerite group, to which also the following named mineral is supposed to belong. This mineral, *karyocerite*, is likewise hexagonal. Its axial ratio is 1 : 1.1845, and its specific gravity 4.295. It differs from melanocerite in containing much more cerium and thorium (CeO_2 and ThO_2). It occurs in nut-brown tables with a rhombohedral habit.—*Weibyeite* occurs in small crystals with a tetragonal habit. In form they resemble zircon, but are really orthorhombic, as their optical investigation shows, with the vertical axis that of least elasticity. $a : b : c$: 1 : .9999 : 1 : .64. It was impossible to separate the mineral from the pairsite associated with it, but an analysis of the mixture leads to the view that weibyeite corresponds in composition to the formula $[(\text{Ce}, \text{La}, \text{Di})\text{F}]_2(\text{CO}_3)_2$.—*Barkevikite*, although long known as a variety of hornblende, has received but little attention in recent years. A new analysis shows it to have the following composition :

TiSiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	CaO	MgO	Na ₂ O	K ₂ O
42.46	11.45	6.18	19.93	.75	10.24	1.11	6.08	1.44

Although chemically not very different from arfvedsonite, its physical properties readily distinguish it from this species. The extinction is $12\frac{1}{2}^\circ$ in the acute β , while in arfvedsonite it is in obtuse β .

This latter mineral is pleochroic in blue and green tints, while the former is pleochroic in brown and brownish red tints. Barkevikite is an essential constituent of the augite syenite occurring between the fjords of Christiania and Langesund.—*Spangolite* is proposed by Penfield³ as the name for a hydrated sulphate and chloride of copper, occurring, probably, somewhere in the Globe District, Arizona. The new mineral incrusts cuprite, and is associated with azurite and atacamite (?). It is rhombohedral, with its crystals bounded by oP and a series of pyramids of the second order. The cleavage is perfect parallel to oP. Etched figures produced on the basal plane by the use of dilute acids are bounded by oP and scalenohedral faces. They are all very clear, and all have an undoubted rhombohedral symmetry. By reflected light the mineral is dark green, while by transmitted light it is light green. Pleochroism is slight. The double refraction is strong and negative, with $\alpha=1.694$, $\epsilon=1.641$. Hardness on oP is 2, and on the pyramidal faces 3. Specific gravity is 3.141. The average of four analyses gives:

SO ₃	Cl	Al ₂ O ₃	CuO	H ₂ O
10.11	4.11	6.60	59.51	20.41

corresponding to $\text{Cu}_2\text{AlClSO}_4 \cdot 9\text{H}_2\text{O}$.

³ *Amer. Jour. Science*, May, 1890, p. 370.



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From the AMERICAN NATURALIST, July, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—A contribution to the knowledge of the geology of South America has recently been made by Bergt² through the study of thin sections of rocks collected in the Sierra Nevada and the Sierra de Peryá in the United States of Columbia. Bergt has confined himself to a description of a large number of rocks that were collected by others, and therefore he has not been able to do more than indicate the interesting results which follow from a close study of their thin sections. Among the facts of general interest discovered may be mentioned the formation of secondary epidote from augite and olivine in melaphyre, and the production of an epidosite therefrom; the occurrence of lamellæ in uralite of syenite, that have become curved through the pressure exerted upon them by a feldspar crystal during its growth; the existence of a rim of brown hornblende around a grain of uralite, and the occurrence of secondary brown mica as a product of the alteration of augite. The writer also discusses the nature of uralite, and suggests that the name uralitite be used as a comprehensive one for those rocks containing secondary hornblende, whose original nature cannot be determined.—Goller³ describes in a very careful article a number of lamprophyre dykes cutting gneiss and crystalline schists in the Vorspessart in Germany. The crystalline schists consist of dioritic and "augen" gneisses, produced by pressure from eruptive rocks, and other gneisses, the history of whose origin is unknown. They are cut by dykes of camptonite and kersantite, whose characteristics are minutely described by the author. Both contain large quartz and orthoclase grains that are supposed to be the remnants of dissolved inclusions, and smaller quartzes that have crystallized from the magma. Two varieties of augite were observed; one alters into talc and tremolite through green hornblende, and the other into serpentine through the same intermediate product. The original quartz is supposed to owe its origin to the physical conditions prevailing during the solidification of the rock mass—principally pressure and the presence of water.—Still other instances of the occurrence of young rocks with the characteristics of old ones are described by Reiser⁴ from four localities in the northern Alps. They are typical diabases and diabase porphyrites of Eocene age. They con-

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² *Min. u. Petrog. Mitth.*, 1889, X., p. 271.

³ *Neues. Jahrb. f. Min.*, etc., B. B. VI., p. 485.

⁴ *Min. u. Petrog. Mitth.*, X., 1889 p. 500.

sist of plagioclase, augite, apatite and secondary substances, and occur with the typical structure of granular and aphanitic diabases. They are characterized by the zeolitization of the plagioclase. Among the zeolites formed are natrolite and analcite, of which the latter has been separated and identified by chemical means.—Thin veins of diabase with tachylite borders have produced fusion along the edges of the slates through which they cut. According to Rutley⁵ the glassy rim produced by the fusion is darker in color than the tachylite selvages of the dyke rock.—N. H. and H. V. Winchell⁶ propose a new theory for the origin of the iron ores of Minnesota, in opposition to the iron carbonate theory⁷ of Irving. The new theory follows the same lines as does Hunt's crenitic hypothesis. It is based entirely on theoretical suppositions, which, so far as is known, can have little foundation in facts.

Mineralogical News.—*Rare Minerals.*—In an article on the minerals of Fiskernäs, in Greenland, Ussing⁸ has given the crystallographic and optical properties of several rare minerals. *Sapphirine* has for its axial ratio $a : b : c = .65 : 1 : .93$. $\beta = 79^\circ 30'$. The axis of least elasticity is inclined $8^\circ 30'$ to the vertical axis, and $2V_{aa} = 68^\circ 49'$. The indices of refraction are $\alpha = 1.7055$, $\beta = 1.7088$, $\gamma = 1.7112$. The mineral is negative, and is pleochroic with A colorless, and B and $C =$ blue, or $A =$ light greenish blue, $B =$ dark bluish green, and $C =$ yellowish sap green. An analysis of the mineral yielded:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MgO	Loss
12.83	65.29	.93	.65	19.78	.31

Kornerupine is orthorhombic with $a : b = .854 : 1$. It has a specific gravity of 3.273, is colorless in thin section, and has $\infty P\bar{6}$ as the plane of its optical axes, with c the acute bisectrix, which is negative. The optical properties of *gedrite* and *pargasite* are also investigated. In a few general remarks on the properties of the former mineral the author states that it is more probable that the optical angle of the orthorhombic hornblendes increases with the increase in the percentage of silica rather than with the increase of iron.—*Atelesite*, analyzed by Busz,⁹ yielded:

As ₂ O ₃	Bi ₂ O ₃	Fe ₂ O ₃	H ₂ O
14.12	82.41	.51	1.92

⁵ *Quart. Jour. Geol. Soc.*, 1889, p. 626.

⁶ *American Geologist*, Nov. 1889, p. 291.

⁷ *AMERICAN NATURALIST*, Dec., 1886, p. 1050.

⁸ *Zeits. f. Kryst.*, 1889, XV., p. 596.

⁹ *Zeits. f. Kryst.*, 1889, XV., p. 625.

The axial ratio, recalculated from von Rath's measurement, is $a : b : c = .9297 : 1 : 1.5123$. $\beta = 69^\circ 35'$. New measurements by Busz gave $a : b : c = .9334 : 1 : 1.5051$. $\beta = 70^\circ 43'$.—*Kobellite*, from the Silver Bell Mine, Ouray, Colorado, has been analyzed by Kellar.¹⁰ Its composition is:

S	Bi	Sb	Pb	Ag	Cu	Fe	Zn	Gangue
18.39	28.40	7.55	36.16	3.31	2.59	1.50	.39	.45,

which may be represented by $2(\text{Pb,Ag,Cu}) \text{S}(\text{BiSb})_2\text{S}_3$. It differs in composition from the mineral called kobellite by Rammelsberg (Pb_2BiSb_2), but is like that to which the name was first given by Selterberg. The same author suggests the name *lillianite* for a substance of the composition $3(\text{PbAg}) \text{Bi}_2\text{S}_3$ described by himself¹¹ several years ago.—*Nivenite* is a rare mineral associated with fergusonite and gummite at the gadolinite locality in Llano County, Texas. It is described by Genth¹² as velvety black, with a brownish streak. It is easily soluble in nitric acid, and possesses the composition:

UO ₃	UO	ThO ₃	Y ₂ O ₃ , etc.	Fe ₂ O ₃	PbO	Ign	Ins	Sp Gr
46.75	19.89	7.57	11.22	.58	10.16	2.54	1.22	8.01

It is allied to bröggerite ($3\text{RO} \cdot \text{UO}_3$) and cleveite ($6\text{RO} \cdot 2\text{UO}_3 \cdot 3\text{H}_2\text{O}$) in containing a large proportion of uranium. Its hardness is 5.5, and its composition is represented by $(9\text{RO} \cdot 4\text{UO}_3 \cdot 3\text{H}_2\text{O})$. Two varieties of *fergusonite* have been found in the same locality. The first corresponds to $\text{Cb}_2\text{O}_3 \cdot \text{R}_2\text{O}_3 \cdot \text{H}_2\text{O}$, and the second to $\text{Cb}_2\text{O}_3 \cdot \text{R}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$. The two are closely associated. The first is probably tetragonal, with a bronzy lustre on a fresh fracture. It is infusible, decrepitates when heated, and changes to an olive green color. The second variety is deep brown in color. Its streak is greenish gray. Upon ignition it turns light brown but does not decrepitate.—*Hydrocerussite* ($2\text{PbO}_2 + \text{Pb}(\text{OH})_2$), corresponding to azurite among the copper salts, has been produced by Bourgeois,¹³ by acting upon lead acetate with ammonium carbonate. The little crystals thus formed have all the properties of the natural substance. By means of them the composition of the mineral has been determined. The white lead of commerce is found by the author to be a mixture of two substances with the composition respectively of cerussite and hydrocerussite.—*Percylite* and *caracolite* are briefly mentioned by Fletcher¹⁴

¹⁰ *Zeits. f. Kryst.*, 1889, XVII., p. 67.

¹¹ *Jour. Amer. Chem. Soc.*, Vol. VII., No. 7.

¹² *Amer. Jour. Sci.*, Dec. 1889, p. 474.

¹³ *Bull. Soc. Franc. d. Min.*, XI., p. 221.

¹⁴ *Min. Magazine*, 1889, p. 171.

as among the many lead salts produced by the decomposition of bournonite and galena at the Mina Beatriz, Sierra Gorda, Chili.

Miscellaneous.—Pseudomorphs of talc after quartz, magnesite and calamine are found not uncommonly in a talc layer at Göpfersgrün, near Wunsiedel in the Fichtelgebirge, near a contact of granite and limestone, that has suffered dolomitization as the result of the action of magnesian solutions emanating from the eruptive rock. The genesis and growth of the talc pseudomorph after quartz are carefully described by Weinschenck¹⁵ as taking place in the following manner. The quartz crystals are first traversed by numerous capillary cracks, running parallel to the prismatic faces and rarely parallel to the rhombohedral planes. Along the sides of these, little plates of talc are developed. From certain points within the crystal other fissures then begin to form, and along the sides of these more talc is formed, until finally there remain only a few isolated areas in which the original mineral can be detected. The production of the new mineral along the cracks leads to the supposition that the change is due entirely to the medium of circulating water, a view that is substantiated by experimental researches.—An important contribution to the discussion of optical anomalies has been made by Erb¹⁶ in a study of sodium acetates of copper, magnesium, nickel, and other metals. When allowed to crystallize slowly these salts form at first uniaxial crystals belonging to the hexagonal system. As they increase in size the crystals become twinned according to certain orthorhombic laws. In thin section they show twinning lamellæ, which disappear when the temperature is raised to 65°. The etched figures produced in both the simple and twinned crystals are of the same shape. They lie in the same relative positions, and are not symmetrically developed about the twinning planes of the lamellæ, but they have the symmetry belonging to the hexagonal system. The twinned crystals are pyroelectric, but upon assuming the isotropic condition they lose this property entirely. To account for these anomalies the author thinks that a strain has been superinduced in them during their growth. If they are mimetic forms it is odd that the crystals should possess a certain grade of symmetry when small, and assume it again when heated.—Upon treating freshly precipitated ferric hydroxide at 250° with water, to which a trace of ammonium fluoride has been added, Bruhns¹⁷ obtained little plates of *hematite* with hexagonal cross sections. Freshly precipitated alumina

¹⁵ *Zeits. f. Kryst.*, XIV., p. 305.

¹⁶ *Neues Jahrb. f. Min. etc.*, B. B. VI., p. 121.

¹⁷ *Neues Jahrb. f. Min., etc.*, 1889, II., p. 62.



when treated in the same way at 300° , yielded little crystalline with pyramidal terminations. *Quartz* crystals with rhombic terminations were produced by heating pulverized glass or a silica to 300° under the same conditions. Microcline gave plates. A mixture of metallic iron, iron oxide and amorphous carbon produced little black amorphous plates of *ilmenite* and *magnetite*. The syntheses are of importance as indicating the possibility of the formation of contact minerals at a low temperature in the presence of traces of fluorine.—Johnston¹⁸ has subjected *covellite* and *biotite* to the action of pure water and to that of carbonic acid for the length of one year. The *muscovite* underwent no change in this time except slight hydration, in consequence of which it becomes a hydro-muscovite resembling *margarodite* in position. *Biotite* during this time becomes bleached under the influence of the carbonic acid. It loses some of its magnesium, iron, assumes water, and passes like the *muscovite* into a hydro-muscovite. Anhydrous micas when they undergo hydration increase in weight, a fact that may help to explain the cause of the rapid weathering of micaceous sandstones.—Bruhns¹⁹ has succeeded in obtaining *glass inclusions* in quartz by heating in a bath of molten granite. The fragments of phreatic and pieces of quartz containing inclusions of fused glass. The resulting glass is entirely surrounded by quartz, and is not a portion of the granitic substance filling cracks produced in the mineral by heating. The inclusions are arranged in straight or curved lines, and have all the properties of inclusions found in porphyritic quartzes.—A brief comparison of the shapes of the etched figures in *diopside* and *spodumene* is made by Greim²⁰. The depressions found on the ∞P faces of the first mineral are nearly triangular, their apices inclined toward the positive hemi-pyramid.—Mr. L. describes a method of determining the values of the optical angles of minerals in thin sections of rocks without the use of convergent light.

¹⁸ *Quart. Jour. Geol. Soc.*, May, 1889, p. 363.

¹⁹ *Neues. Jahrb. f. Min., etc.*, 1889, I., p. 268.

²⁰ *Miner. Magazine*, May, 1889, p. 252.

²¹ *Amer. Jour. Sci.*, Jan., 1890, p. 53.



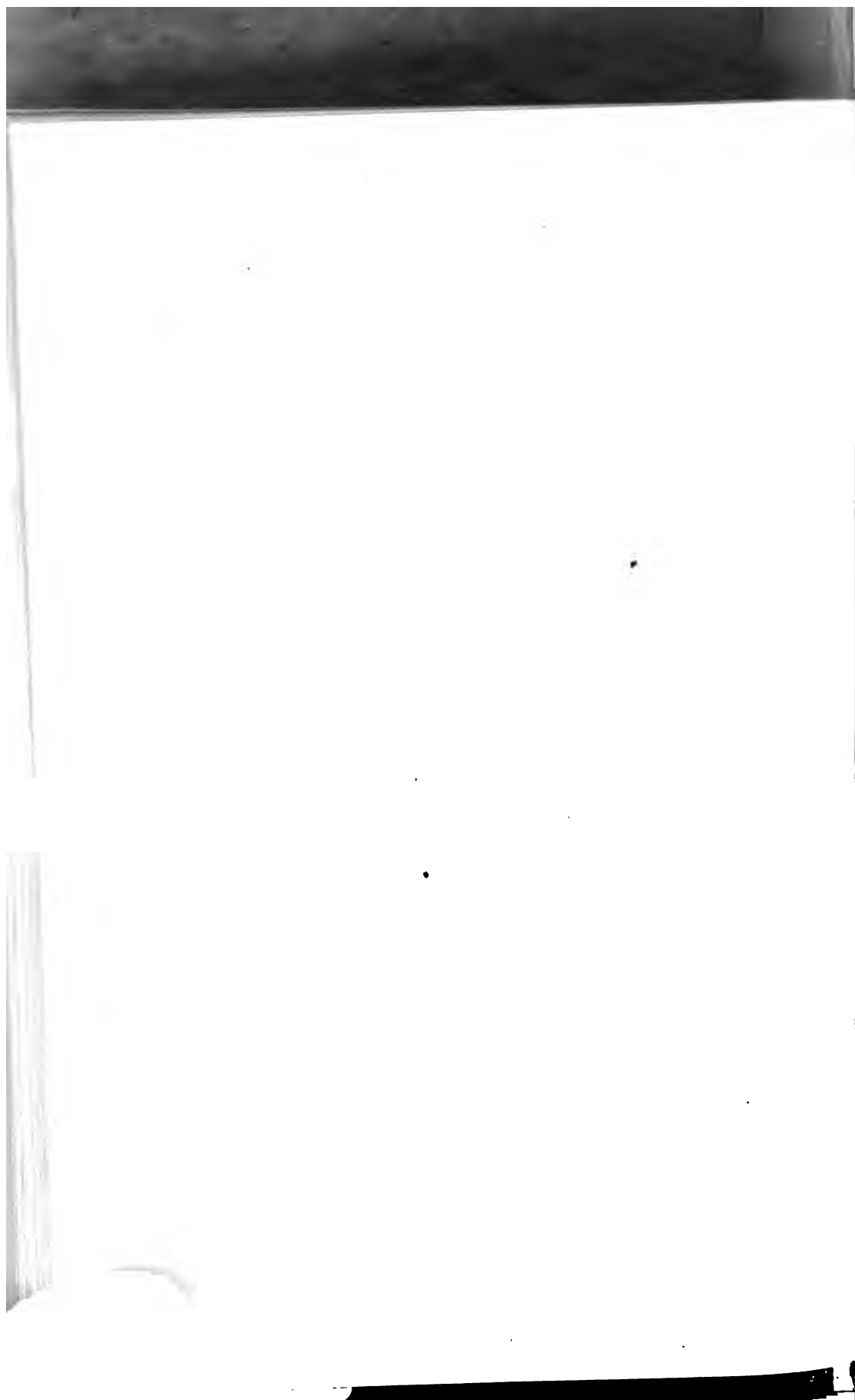
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The quartz fragments are surrounded by zones of colorless glass containing augite microlites, which are in turn surrounded by zones of brown glass enclosing microlites and crystals of augite and granules of magnetite.—According to Vénukoff,⁴ basalts play an important role in the geology of Mongolia. They consist principally of feldspar, augite, olivine, ilmenite, and magnetite. The feldspar is usually in but one generation. When in two, the phenocrysts are anorthite and the microlites labradorite. The augite is usually in two generations, the larger crystals being violet in color, while the smaller ones are green. In some cases the porphyritic augites are made up of an aggregate of small grains grouped in such a way as to present the outline of crystals. These aggregates are sometimes surrounded by a rim of grains of the second consolidation. Between the minerals above mentioned there is often a little of an amorphous base containing globulites and microlites. The quartz of an inclusion of granite in this basalt is surrounded by a zone composed of augite and small, light-colored microlites. The biotite of the granite has been transformed into a granular mass of magnetite, quartz, and a light brown opaque substance. Around it is often a zone of augite grains. Around the feldspar the basalt paste becomes light colored, the crystal components are more rare, and in their places are various microlites. Within this is a band of augite microlites, and within this band, immediately surrounding the feldspar, is a zone of colorless glass. The feldspar itself is much fractured.—The greenstones⁵ of Wicklow, Ireland, occur in intrusive sheets and dykes. They are quartz-micadiorites (composed of quartz, plagioclase, orthoclase, biotite, hornblende, and a little malacolite, chlorite, and apatite), quartz-diorites, diorites, augite-diorites (consisting of plagioclase and grains and crystals of sahlite or malacolite), diabases, epidiorites, chlorite-schists (produced by dynamic metamorphism from diabase), and serpentines, derived from diabases.—Mr. Somervail⁶ regards the gabbros, greenstones, granulites, and hornblende-schists of the Lizard, Eng., as parts of the same rock-mass, the latter-named rocks, according to him, having originated from the former by pressure.—Mr. Marstens⁷ gives us a very brief description of diabases and diabase porphyrite from among the Triassic traps of Nova Scotia.—A few dykes⁸

³ *Ib.*, p. 340.

⁴ *Proc. verb. soc. Belg. de Géol.*, II., 1888, p. 441.

⁵ *Geol. Magazine*, 1889, p. 261.

⁶ *Geol. Magazine*, Sept. 1889, p. .

⁷ *Amer. Geol.*, Mch. 1890, p. 140.

⁸ Darton and Diller. *Amer. Jour. Sci.*, Apr. 1890, p. 269.



occurring in the Upper Silurian and Lower Devonian beds of the Appalachians in Highland Co., Va., consist of porphyritic basalt composed of phenocrysts of augite and olivine in a ground-mass of plagioclase, augite, magnetite, and a few flakes of biotite.—Sandberger⁹ mentions cordierite occurring as an inclusion in the basalt of the Calvarienberg, near Fulda, in Hessen. He also gives an analysis of the phonolite of Heldburg, near Coburg.—Holland¹⁰ has isolated the porphyritic crystals from the basalts of Mull, Eng., and finds them to correspond in composition and other properties with anorthite of the composition $AbAn_2$.—In the phonolite of the Serra de Tingua, Brazil, are coarse-grained patches with the structure of foyaite. They have the form of leucite crystals, and are, according to Hussak,¹¹ nothing more or less than pseudo-crystals of this mineral. They consist of a thin wall composed of crystals of orthoclase, surrounding a coarse-grained aggregate of the constitution of foyaite. The external form of the pseudomorphs is so perfect that the angles of leucite can readily be detected upon them.—Mr. C. W. Hall¹² records the fact that the Trenton limestone of St. Paul and Minneapolis., Minn, is composed of untwinned rhombohedra of calcite. An argillaceous bed lying above the limestone contains many rhombohedra of calcite imbedded in its matrix.—Dr. Lawson¹³ describes an amygdaloidal trap from the Animikie series of Thunder Bay, Canada, that contains about 2% of native copper.

Mineralogical News.—NEW MINERALS.—*Inesite*.—At the mine Hilfe Gottes and Ferdinand, near Nanzenbach in the Dillenburg region, Germany, is a new manganese mineral associated with various ores of this metal. The new mineral is a dense colorless to dark brown substance, whose hardness varies between 5 and 6, and whose streak is yellowish-brown. Its fusibility is 3. In other specimens the mineral occurs in radial aggregates of a flesh-red color, with a hardness of 6–7, a specific gravity of 3.103, a white streak and a glassy lustre. It has an extinction of 20° against one of its cleavages, and is regarded by Schneider¹⁴ as triclinic. Its composition is

SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	H ₂ O
43.92	.29	.69	38.23	.28	8.00	8.49

⁹ *Neues Jahrb. f. Min., etc.*, 1890, I., p. 101.

¹⁰ *Miner. Magazine*, Mch. 1889, p. 154.

¹¹ *Neues Jahrb. f. Min., etc.*, 1890, I., p. 166.

¹² *Bull. Minn. Acad. Nat. Sciences*, Vol. III., No. 1., p. 111.

¹³ *Amer. Geologist*, Mch. 1890, p. 174.

¹⁴ *Zeits. d. deutsch. geol. Ges.*, XXXIX., 1889, p. 829.

In many of its characteristics it resembles rhodotilite. Its axial ratio, as calculated by Scheibe,¹⁵ is $a : b : c = .9753 : 1 : 1.3208$, with $\alpha = 92^\circ 18' 12''$, $\beta = 132^\circ 55' 54''$, $\gamma = 93^\circ 50' 42''$.—*Rhodotilite* is described by Flink¹⁶ from the Harstig mine, Pajsberg, Sweden. It is identical in all its properties with *inesite*, but is fresher. Its analysis gave :

SiO ₂	FeO	MnO	MgO	CaO	PbO	H ₂ O
43.67	1.11	37.04	.15	9.38	.77	7.17.

which corresponds with the formula $2 (\text{MnCa}) \text{SiO}_3 + \text{H}_2\text{O}$. Recognizing the similarity between *rhodotilite* and the mineral described by Schneider under the name *inesite*, Flink has determined to withdraw the former name and has decided to adopt the one proposed by Schneider.—*Lussatite* is described by Mallard¹⁷ as a milky-white fibrous substance surrounding quartz crystals, occurring in the bituminous beds of Lussa, Pont-du-Chateau, France. The fibres are arranged perpendicularly to the bounding planes of the quartz. They have a density of 2.04, and contain 7.9–8.3% of water, which they lose when heated without changing their optical behavior. The loss of water is supposed to be due to a mixture of opal with the fibrous mineral, which the author regards as crystallized silica differing from quartz and chalcedony, since it possesses optical properties that differ from those of these minerals. Its index of refraction for sodium light is 1.446.—*Heliophyllite*, from Pajsberg is a shining, sulphur-yellow, flaky substance¹⁸ accompanying the *inesite* (rhodotilite) from the Harstig mine. It resembles, in appearance, a mineral described by Nordenskjöld¹⁹ as associated with *ekdemite* at Långban. The new mineral is orthorhombic, with the plane of its optical axes normal to the cleavage face. The axial angle is large, and the dispersion $\rho > v$. The density is 6.886, and hardness 2. On the Långban mineral the planes P_∞ and oP occur on twinned forms, with ∞P the twinning plane, and $a : b : c = 1.0343 : 1 : 2.2045$. *Heliophyllite* has practically the same composition as *ekdemite*, from which, however, it differs in its crystallographic properties.

	PbO	MnO. FeO	As ₂ O ₃	Cl
Heliophyllite	80.70	.54	11.69	8.00
Ekdemite	81.28		12.03	8.63

¹⁵ Ref. *Neues Jahrb. f. Min.*, etc., 1890, I., p. 21.

¹⁶ Öfv. af Kongl. Vetensk. Ak., För. 1888, Stockholm, p. 571. ref. *Neues Jahrb. f. Min.*, etc., 1890, I., p. 22.

¹⁷ Comptes Rendus, 110, p. 245. Ref. Ber. d. deutsch. chem. Ges., 1890, p. 170.

¹⁸ Flink : Öfversigh. af Kongl. Vetensk. Akad. Förh., 1888, Stockh., p. 571.

¹⁹ Geol. Fören. Förh., III., p. 381. Ref. *Neues. Jahrb f. Min.*, etc., 1890, I., p. 23.



—*Barysite*.—At the same Harstig mine Sjögren and Lundström²⁰ found a lead silicate associated with garnet, calcite, tephroite, hematophane and cerussite filling a vein in the iron ores. The mineral occurs in silver-white hexagonal crystals, with a perfect cleavage parallel to ∞P and a less perfect one parallel to ∞P . Its double refraction is negative, streak white, hardness, 3, and specific gravity, 6.55. When heated it becomes dark and melts to a brown glass. Dissolves in nitric and hydrochloric acids with the separation of gelatinous silica. Composition (as a mean of two analyses) is:

SiO ₂	PbO	MnO	FeO	CaO	MgO	Ce	Loss.
17.07	78.26	3.51	.16	.41	.59	tr.	.89

leading to the formula $3 (\frac{1}{3} \text{MnO} + \frac{1}{3} \text{PbO}) 2 \text{SiO}_2$.

Miscellaneous.—The second part Hintze's "Handbuch der Mineralogie"²¹ concludes the discussion of the topaz group of minerals, and treats of the datholite and epidote groups, vesuvianite, gehlenite, and part of the tourmaline group. The fullness of treatment that characterized the first part of this remarkable book is continued in the second part. The promise given by the two parts that have appeared to date is carried to its fulfillment, the complete volume will be a marvel of painstaking labor and patience.—A discussion of some of the facts known with respect to the physical symmetry of crystals, together with some observations made upon the gypsum of Zimmersheim, in Upper Alsace, lead Beckenkamp²² to the view that the molecules of crystals are polar, *i.e.*, that they possess different powers at diametrically opposite points, and that, other conditions being similar, a crystal face always possesses a maximum tendency to growth in a certain fixed direction.—In a conglomerate on the Coast of South Devon, near Torquay, England, are numerous pieces of limestone, on the surface of which are botryoidal and spherulitic forms of chalcedony, known as beekite. These are thought by Hughes²³ to have originated by the replacement of portions of the limestone by silica, possibly through the influence of organic substances. The author thinks that the same kind of action may have given rise to many of the old siliceous deposits like flint or chert.—Mr. Dawson²⁴ has recently given a statement of the present condition of mining in British Columbia, and a description of the minerals of economic value occurring there, and Mr. Coste²⁴ has issued a statistical

²⁰ Öfvers. af. Kongl. Vetensk. Ak. Förh., p. 7. Ref. *Neues. Jahrb. f. Min.*, etc., 1890, I., p. 24.

²¹ Dr. C. Hintze: *Handbuch der Mineralogie*, 2d Lief. Leipzig. Veit and Comp., 1890.

²² *Zeits. f. Kryst.*, XVII., 1890, p. 321.

²³ *Miner. Magazine*, Oct., 1889, p. 265.

²⁴ Ann. Rep. Geol. and Nat. Hist. Surv. of Can. for 1887-88. Repts. R and S.

report on the mineral products of Canada.—In the tourmaline of the tourmaline granite of Striegau, Traube²⁵ has discovered pleochroic halos around inclusions of rutile and zircon. The color of the halos is some shade of violet, and is independent of the color of the mineral in which they lie. It disappears upon heating. Garnet, apatite, and quartz inclusions in the same tourmaline are not surrounded by halos.—Among the new instruments, and improvements upon old instruments, used in crystallographic and mineralogical investigations, that have been suggested during the last three months, mention may be made of an apparatus²⁶ for the production of pressure figures in very small mica plates; of a very simple reflection goniometer constructed by Prof. Groth²⁷; of an improved instrument²⁸ for cutting thin sections of minerals in any desired position; and an improved heating apparatus for use with the reflection goniometer, invented and constructed by the well-known mechanician Fuess.²⁹

²⁵ *Neues Jahrb. f. Min.*, etc., 1890, I., p. 186.

²⁶ Steenstrup: *Geol. Fören. Förh.*, Stock., 1888, p. 113. Ref. *Zeits. f. Kryst.*, XVII., p. 429.

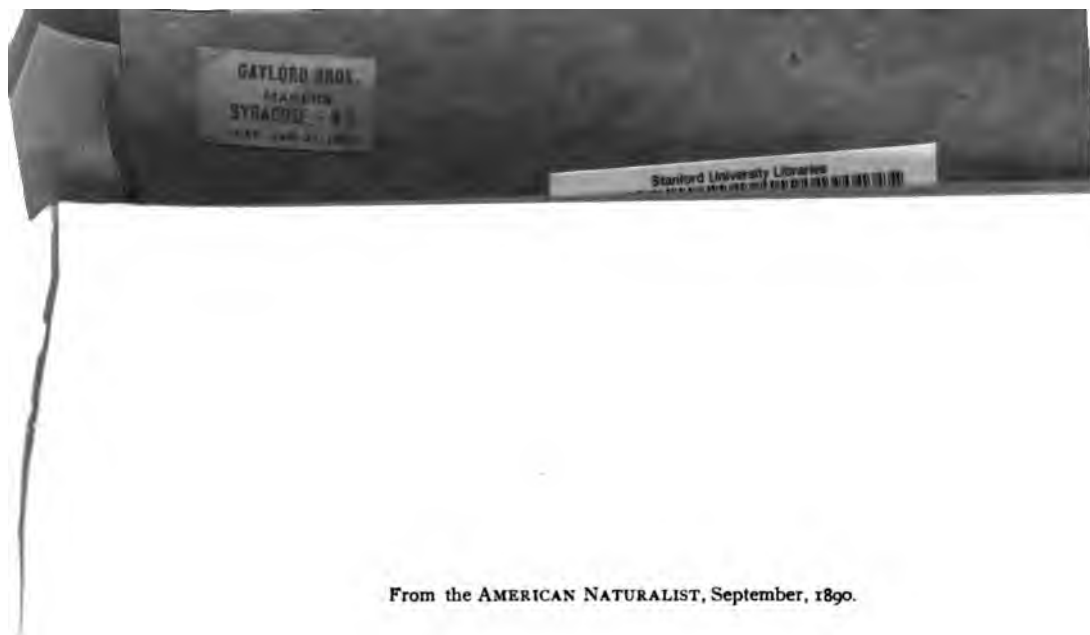
²⁷ *Zeits. f. Kryst.*, XVII., 1890, p. 396.

²⁸ *Ib.* XVII., 1890, p. 445.

²⁹ *Neues Jahrb. f. Min.*, etc., 1890, I., p. 161.







From the AMERICAN NATURALIST, September, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—The results of the investigation of the clastic, metamorphic, and eruptive rocks of the Coast Ranges of California, promised by Mr. Becker a few years ago,² have recently³ appeared in an extended form. The principal conclusions of the study have already been referred to in these notes. The proofs which Mr. Becker offers for the correctness of the statements that many serpentines of the Coast Ranges are altered sediments will probably be accepted by most petrographers as sufficient. His conclusion that typical diabases, diorites, and gabbros are likewise derived from clastic materials will not find such ready acceptance, as there seems to be no positive evidence that such rocks were originally sediments, rather than eruptives, which squeezed themselves into fragmental beds, and so caused the formation of a graded series, with sandstone at one end and a holocrystalline rock at the other end. There is no reason to suppose that holocrystalline⁴ rocks may not have sometimes originated by metasomatic alteration of fragmentals; but the belief that a rock with the peculiar structure of diabase has originated in this way will require stronger proof for its acceptance than that offered in Mr. Becker's monograph. The presentation of a few illustrations of types of rocks intermediate between the sandstones and the diabases (pseudo-diabases of Becker, metadiabases of Dana) would have aided materially in enabling readers of the volume to draw their own conclusions as to the origin of the rocks in question. In the discussion of the massive rocks of the region, the term asperite is proposed as a general one to include all andesitic rocks with a rough trachytic habit. In this

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² AMERICAN NATURALIST, Aug. 1886, p. 724.

³ Monographs of the U. S. Geol. Survey, Vol. XIII., pp. 56-175.

⁴ Cf. Van Hise. AMER. NATURALIST, 1886, p. 723.

portion of the volume are also described andesitic and basaltic glasses, which are much more acid than the holocrystalline rocks with which they are associated. The basalt glass has the composition of an obsidian, and passes into a rock with the appearance of basalt. Analyses I. and II. are of obsidian and basalt respectively :

	SiO ₂	P ₂ O ₅	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	NiO	CaO	MgO
I.	75.40			7.72	1.41		.12		1.55	1.26
II.	57.37	.02	.60	15.66	2.06	4.46	.27	.41	4.94	8.84
	Na ₂ O	K ₂ O	Cl	H ₂ O	Sp. Gr.					
	8.00	4.52	.12	.43	2.39					
	3.05	1.50		.74	2.83					

The difference in structure of the two rocks is supposed to be due to differences in composition of the original magma.—As an introduction to his description of the minerals of the syenite-pegmatite veins of Southern Norway, Brögger⁵ gives a short account of the geology of the region in which these veins occur, and gives his reasons for regarding the latter as eruptive in origin, as against the lateral secretion theory proposed to account for them. Since the article is itself an abstract of a monograph on the geology of the region, it is difficult to give a résumé of its contents. Among the rocks discussed are some new types, to which reference may be made. Laurvikite is a typical augite-syenite composed of anorthoclase (or cryptoperthite) diopside, ægerine, and lepidomelane, with small amounts of barkevikite, olivine, sphene, magnetite, apatite, zircon, nepheline, cancrinite, and sodalite. It is granitic in structure, except on its periphery, where it is developed as the well-known rhombic porphyry. This latter occurs also as dykes in the former and as flows. A variety of the laurvikite, in which oligoclase is present in addition to the anorthoclase, and in which the latter mineral has rectangular rather than the rhombic cross sections which characterize it in the laurvikite Brögger calls augite-mica-syenite, since it contains very little nepheline. Another rock very characteristic of the region is called laurdalite. This is a coarse-grained nepheline-syenite, with or without olivine. It contains more nepheline and sodalite than does laurvikite, and the former mineral is porphyritically developed. It is the rock described by the author as nepheline-syenite⁶ in a former publication. The dyke rock corresponding to laurdalite is a nepheline-rhombic-porphyry, which differs from the porphyritic laurvikite in containing nepheline in its

⁵ *Zeits. f. Kryst.*, etc., XVI., 1890.

⁶ *Silur. Elagen*, 2 and 3, p. 273.

ground-mass. Three other varieties of dyke rock corresponding to laurdalite are recognized. The first is granitic, and is called ditroite; the second is trachytic in structure, and has been denominated foyaite; while the third has phenocrysts of elæolite in a granitic ground-mass. This a nepheline-porphyry. Hedrumite is trachytic, but it contains no elæolite, or, if any, but a small quantity. A tinguaita variety of these rocks is also recognized. Among the acid rocks a quartz-bearing augite-syenite is distinguished by the name akerite. This rock is composed of orthoclase, plagioclase, a large amount of brown biotite, idiomorphic diopside, nepheline, sodalite, usually olivine, and nearly always quartz. Its structure is granitic, and its peripheral facies is a quartz-porphyry. Several varieties of the rock were discovered, one of which is a hypersthene-akerite. More acid than akerite is nordmarkite, which is a quartz-syenite, consisting of micropertthite, a diopside pyroxene, biotite, glaucophane or ægirine, and arfvedsonite, sphene, and a little zircon. It is granitic, with quartz in ordinary granite form. Since the rock contains less than 66% of SiO_2 , it is called quartz-syenite, rather than soda-granite. The corresponding effusive rock is a quartz-rhombic-porphyry, with a poicilitic ground-mass of quartz and feldspar. Soda-granite is developed in several varieties, among which hornblende, arfvedsonite, and ægirine varieties are the most important. The structure of the rock is not strictly granitic, consisting, as it does, of a ground-mass composed of short rectangular orthoclase, quartz, needles of ægirine, apatite, etc., with a few phenocrysts of microcline and ægirine. The author proposes that the rock be called grorudite. Very many more special phases of these various rocks are recognized, but a full description of them is left to the promised monograph. The larger part of the introductory portion of the volume is occupied with arguments to show that the pegmatitic veins so common in South Norway, as well as in other regions of old rocks, are true fillings of fissures by what was once a molten magnea.—Toula⁷ announces the results of the examination of rocks collected during several trips through the Balkans. The rocks of the Central Balkans are divided into massive rocks and crystalline-schists, among the former of which granite, diorites (including nadel-diorite), uralite-diabase, microgranite, orthophyres, porphyrites, pepheline-basalt, limburgite, and andesitic and porphyritic tufas are described; among the latter granitic, hälleflinta and other gneisses and quartz-phyllites are mentioned. In the Eastern Balkans are fossiliferous sandstones and limestones and eruptive rocks, including granites,

⁷ *Neues Jahrb. f. Min., etc.*, 1890, II., pp. 263, 273.

diorites, porphyrites, quartz-porphyry, andesites, and trachytes of various kinds, phonolites, augitites and tufas.—Lacroix⁸ announces the discovery of a peculiar rock, composed of garnets, quartz, orthoclase, oligoclase, nitite, and diaspoire, occurring in blocks cast from a volcano near Bournac in the Auvergne.—Mr. Nason⁹ gives a brief description of the crystalline rocks occurring in the Highlands of New Jersey.

New Minerals.—In addition to the numerous new minerals lately discovered by Börgger in the Scandinavian Peninsula, five others have recently been described. These latter are from Sweden; the discovery of them is due to Igelström.⁹—*Talcknebelite*, from the iron mine Hillång, Ludvika Parish, Gouvernement Dalekarlien, is associated with small red garnets. In appearance it resembles *igelströmite*, but is lighter and has a pearly lustre on a fresh fracture. In composition it is a magnesium bearing knebelite as follows: $\text{SiO}_2 = 33.1$; $\text{FeO} = 42.6$; $\text{MnO} = 21.6$; $\text{MgO} = 4.7$.—*Ferrostibian* has been found imbedded in massive rhodonite at the Sjögrufvan Mine, Grythyttan, Oerebo. The crystals are quite large. They are probably monoclinic, and bounded by ∞P , $\infty P \infty$ and $\infty P \infty$. They are black and opaque, with a brownish-black streak, and are weakly magnetic. They have a hardness of 4, and in thin section are blood red in color. The mineral dissolves with great difficulty in the usual reagents. An analysis gave:

SiO_2	$(\text{MgCa})\text{CO}_3$	Sb_2O_3	FeO	MnO	H_2O
2.24	2.14	14.18	22.60	46.97	9.19

Regarding the silica and carbonate as impurities, and the manganese and iron as in the "ous" condition (which could not be proven), the analysis may be expressed by the formula $10 \text{RO} \cdot \text{Sb}_2\text{O}_3 + 10 (\text{RO} \cdot \text{H}_2\text{O})$.—*Pleurasite* is a hydrate arsenate from the same mine. It is implanted in arseniopleite. It is bluish-black and opaque, but in thin section becomes pale red. It has a half metallic lustre, a black streak tinged with red, and a hardness of 4, and is very weakly magnetic. It dissolves readily in dilute hydrochloric acid, and yields a yellow solution. Analyses have not yet been made, but qualitative tests indicate that it is a hydrated manganese iron arsenate, containing some antimony.—*Stibiatite*, also from the same mine, occurs in small crystals imbedded in polyarsenite and in irregular grains in veins of various minerals cutting the manganese ores of the mine. The crystals appear

⁸ Bull. Soc. Fran. d. Min., Jan. 1890, p. 7.

⁹ Ann. Rep. State Geologist of New Jersey for 1889, p. 30.

⁹ Neues Jahrb. f. Min., etc., 1890, I., p. 248.



to be orthorhombic. They are raven black and perfectly opaque even in the thinnest sections. They are easily soluble in hydrochloric acid and are not magnetic. An approximate analysis gave: $\text{FeO} = 26$; $\text{Mn}_2\text{O}_3 = 44$; $\text{Sb}_2\text{O}_3 + \text{H}_2\text{O} = 30$.—*Neotesite*, also from the Sjögrufvan, occurs in lamellar masses associated with tephroite, pyrroarsenite, and calcite. It resembles in appearance red orthoclase. It has a good cleavage, a hardness of 5–5.5. It is soluble in acids, leaving a residue of flocculent silica. Its composition:

SiO_2	MnO	FeO	MgO	H_2O
29.50	40.60	tr.	20.05	9.85

corresponds to $(\text{MnMg})_2\text{SiO}_4 + \text{H}_2\text{O}$, *i.e.*, to a hydrated tephroite. The author, however, does not regard it as a decomposed tephroite.—*Antlerite* is a light green, massive mineral from the Antler Mine, Mohave County, Arizona, which, according to Hillebrand,¹⁰ has a specific gravity of 3.93, and a composition as follows: $\text{CuO} = 67.91$; $\text{ZnO} = 16.5$; $\text{CaO} = .05$; $\text{SO}_3 = 20.77$; $\text{H}_2\text{O} = 10.93$, corresponding to $3 \text{ Cu SO}_4 + 7 \text{ Cu(OH)}_2$.—*Selen-tellurium*, from El Plomo Mine, Tegucigalpa, Honduras, is nearer in composition to native selenium, according to Messrs. Dana and Wells,¹¹ than any substance known. It is regarded as an isomorphous mixture of the two metals indicated by its name, in the proportions $\text{Se} = 29.31$, $\text{Te} = 70.69$. It occurs massive, has an indistinct columnar structure, and is blackish-gray in color. Its cleavage indicates hexagonal crystallization.—*Durdenite*, a greenish-yellow mineral associated with native tellurium, is thought by the same authors to be a ferric tellurite corresponding to $\text{Fe}_2(\text{FeO}_3)_2 + 4 \text{ H}_2\text{O}$, but differing from the ferric tellurite described by Hillebrandt under the name emmonsite.—*Hamlinite*.—Messrs. Hidden and Penfield¹² describe a rhombohedral mineral occurring at Stoneham, Maine, in small crystals, associated with herderite, margarodite, and bertrandite. The material available for study was so small that no chemical analysis of it was possible. The crystals are bounded by oR , R , and $-\text{zR}$, with oR predominating, $a : c = 1 : 1.135$. The cleavage is perfect, parallel to the base, and the lustre on this face is pearly, while on the rhombohedral faces it is vitreous and greasy. The double refraction is weak and positive. Hardness = 4.5; Sp. Gr. = 3.228. Blow-pipe tests prove the mineral to be a phosphate of beryllium and aluminum containing fluorine.—*Phosphosiderite* is a new mineral from

¹⁰ Bull. U. S. Geol. Survey, No. 55, p. 48.

¹¹ Amer. Jour. Sci., July, 1890, p. 78.

¹² Amer. Jour. Sci., June, 1890, p. 511.

the Kalterborn Mine, near Eiserfeld, Siegen.¹³ It is in the form of blood red or reddish-violet aggregates lining cavities in an iron ore. It is transparent, and has a hardness of 3.75, and a density of 2.76. In the glass tube it becomes yellow and opaque and loses water. Dissolves in hydrochloric acid, but is almost insoluble in nitric acid. An analysis gave $\text{Fe}_2\text{O}_3 = 44.30$; $\text{P}_2\text{O}_5 = 38.85$; $\text{H}_2\text{O} = 17.26$, corresponding nearly to $2\text{Fe}_2\text{O}_3 \cdot \text{P}_2\text{O}_5 + 8\text{H}_2\text{O}$, which is the formula for strengite. The new mineral differs from strengite in containing about two per cent. less water, and in losing all of this in one stage. Phosphosiderite is orthorhombic, with $a:b:c = .5330:1:.8772$. The cleavage is parallel to $\infty P\infty$, which is the predominant form. Prismatic forms are also largely developed. Twins, with $P\infty$ the twinning plane, are met with. The mineral is optically positive, with $\infty P\infty$ the axial plane and c the acute bisectrix, $2 V_{na} = 62^\circ 4'$ and $\rho > \nu$. Pleochroism is $a = \text{pale rose}$, $b = \text{carmine}$, $c = \text{colorless}$.

Miscellaneous.—The U. S. National Museum has just published two pamphlets of some interest. One is by Mr. Kunz,¹⁴ and contains a readable account of the gems in the possession of the institution. The second is of more special interest to mineralogists. It is a complete catalogue of mineral names, with their synonyms in French, German, and other languages. The volume is by Dr. Egleston,¹⁵ of Columbia. It is intended to serve as an aid to those who arrange and keep in order large collections of minerals, a purpose that it will surely serve. — The first part of volume second of the Report of the Geological Survey of New Jersey¹⁶ contains a full list of the minerals found in that State. — The well-known instrument maker, Fuess,¹⁷ has recently given very full and clear descriptions of some petrographical microscopes manufactured by himself after suggestions offered by practical mineralogists and petrographers, and of some newly-constructed apparatus for use with these. The most novel of the latter are an axial angle apparatus and a goniometer attachable to the stage of the microscopes.

¹³ Bruhns and Busz: *Zeits. f. Kryst.*, XVII., 1890, p. 555.

¹⁴ Rep. Smith. Inst., 1885-6, Pt. II., p. 267-275.

¹⁵ Bull. U. S. Nat. Mus., No. 33, Wash., 1889.

¹⁶ Geol. Sur. of N. J. Rep. of State Geol., Vol. II., Pt. I., Trenton, 1889.

Neues Jahrb. f. Min., etc., BB. VI., 1890, p. 55.







From the *AMERICAN NATURALIST*, November, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—A most important contribution to the study of the origin of the crystalline schists has lately been made by Van Hise,² through the medium of the Bulletin of the recently organized Geological Society of America. It will be remembered that only a short time ago this writer³ showed that certain mica-schists of the Penokee-Gogebic region in Wisconsin and Michigan are nothing less than sediments, in which secondary mineral changes have taken place. He now goes further, and shows that under the influence of pressure, and probably heat, the pre-Cambrian slates and conglomerates of the Black Hills, Dakota, have been changed into schistose rocks, among which are gneisses. The reasons given for this conclusion are : (1) The gradation of the slates into schists, with loss of slaty cleavage, and the development of a foliation, usually oblique to the cleavage, and sometimes even perpendicular to it ; (2) the concentric arrangement of the schists around granitic areas in such a way that the strike of their foliation is always parallel to the boundaries of the eruptive rock, and the dip always inclined away from them ; (3) the clear evidence afforded by the microscope to the effect that the rocks intermediate between the schists and slates have all suffered squeezing to such an extent that their various constituents, more particularly the quartz, have been flattened, cracked, and even broken, so that their different parts extinguish differently ; and finally (4) the certainty that much of the material of the schists is of secondary origin. The new minerals produced by the forces at work are silica in different forms, biotite, muscovite, and feldspar, and sometimes hornblende, garnet, tourmaline, and staurolite. In the less schistose varieties the grains of the original slates can be distinguished, as they are outlined by a layer of ferrite deposited upon them before they had lost their characteristic shapes. The quartz grains are flattened in the direction of the line of supposed pressure, and are broken. The cracks are often filled with particles of iron oxides, and sometimes are marked by lines of fluid inclusions. The deposition of silica around the fractured quartz grains and the production of secondary mica and feldspar are regarded as abundantly able to change a slate into a schist, especially when foliation has been

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² Bull. Geol. Soc. of Am., Vol. I., p. 203.

³ *AMERICAN NATURALIST*, Aug. 1886, p. 723.

superinduced by pressure, with the aid of heat sufficient for the fusion of the original sediments. Attention is called to the fact that these schists are not members of the great complex underlying the earliest sedimentary rocks, but are contemporaneous with some of the latter which are probably of Huronian age.—After a very thorough discussion of fifty-three analyses of plutonic and effusive rocks Rosenbusch⁴ concludes that the cause of the great variety in the rocks extruded from an eruptive center is the capacity of an original magma for separating into portions with different compositions (*Spaltungsfähigkeit*). These different portions may exist under the earth's crust in positions very near each other. From the very nature of the discussion, depending as it does upon so much detail, it is impossible to reproduce its argument in these pages. It must satisfy our present purposes to state that Prof. Rosenbusch thinks the original magma had a composition near that of a mixture of *elæolite-syenite*, *peridotite* and residues of the formulas $(\text{NaK})\text{AlSi}_2$ and R_2Si . The residue $(\text{NaK})\text{AlSi}_2$ possesses the capacity of taking up silica and yielding granite magma. The first splitting of the original magma yielded derivative magmas (*theilmagmen*), which have solidified as plutonic rocks. Further differentiation produced the materials whose solidification yielded the effusive rocks. This explanation of the differences existing in the composition of the plutonic rocks and their corresponding effusives is thought by Rosenbusch to be better than that which ascribes them to a separation of the original magma according to the density of its parts, whereby the highest portions (those producing the effusive rocks) had of necessity a different composition from the lower portions. The paper contains significant utterances with respect to the relations between the geological age of a rock and its structure. It is said that the difference between older and younger effusive rocks is "that the former have existed on the surface for a longer time than the latter, and consequently have suffered a series of changes (*umbildenden Processen*) . . . One needs no great gift of penetration to prophesy that in the near future this separation [of the paleovolcanic from the neovolcanic rocks] will lack recognition."—Dahms⁵ has examined a set of hand-specimens brought from the Transvaal, Africa, among which he recognizes gabros containing pleochroic diallage and augite, the two minerals occurring in different parts of the same mass, and secondary quartz and hornblende. He finds also diabases and quartz-diabases, a quartz-porphyry in whose quartz-phenocrysts are inclusions

⁴ *Miner. u. Petrog. Mitth.*, XI., 1890, p. 144.

⁵ *Neues Jahrb. f. Min.*, etc., Beil. Bd., VII., 1890, p. 90.

of carbon-dioxide, augite-porphyrine, granite, and granitic and syenitic porphyries. Each of these rocks is described, and analyses of several of them and their constituents are given. The most interesting point brought out by the analyses has reference to the relation between the diallage of a gabbro and the secondary hornblende derived from it.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	Na ₂ O	K ₂ O	H ₂ O
Diall.	53.53	3.12	5.09	13.54	6.19	18.77	.57	.20	
Hornb.	52.73	4.70	5.26	10.21	12.58	12.59	.23	.06	1.54

An increase in CaO and decrease in MgO in passing from diallage to hornblende is in opposition to the view held in regard to the nature of the change. The author is compelled to look upon it as paramorphic. —Cathrein⁶ has re-examined the rock from Ehrwald in the Tyrol, called by Pichler augite-porphyrine, and thought by Rosenbusch to belong possibly with the teschnites, and has found it to consist of phenocrysts of augite, both monoclinic and orthorhombic, in a ground-mass composed of crystals of biotite, pyroxene, hornblende, apatite, and magnetite, in a base containing some radially fibrous mineral in an isotropic substance. The rhombic-pyroxene has been changed to bastite, which is intergrown with biotite and augite, and is surrounded by small crystals of augite of the second generation, of hornblende, and of biotite. The augite of the ground-mass is grouped in aggregates resembling chondrites, and is pleochroic in violet and yellowish-red tints. The author classes the rock with the augitites, and calls it bastite-augite or Ehrwaldite. —Spherulites composed of radiating bundles of an alkaline feldspar and spherical masses of tridymite occur in the obsidian of the Lipari Islands, according to Mr. Iddings.⁷ They are similar to the spherulites and lithophysæ of the rock from Obsidian Cliff, and contain, like the latter, little honey-yellow crystals of fayalite. —In an appendix to an article by Mr. Barlow⁸ on the contact of the Huronian and Laurentian rocks north of Lake Huron, Dr. Lawson briefly describes a few sections of quartzites on the contact with gneisses, in the former of which he believes are evidences of contact alteration, in which event the gneisses must be regarded as eruptive. —Mr. Fairbanks⁹ has examined eighty sections of basic dykes from the north shore of Lake Huron, and has found them to be diabases, diorites, and alteration products of these.

⁶ *Verh. d. k. k. geol. Reichsanst.*, I., 1890, p. 1.

⁷ Iddings and Penfield, *Amer. Jour. Sci.*, July, 1890, p. 75.

⁸ *Am. Geologist*, July, 1890, p. 19.

⁹ *Ib.*, Sept., 1890, p. 162.

Mineralogical News.—In two very much decomposed rocks from Custer County, Colorado, Mr. Cross¹⁰ has discovered an interesting series of secondary *hornblendes* and *pyroxenes*, whose study leads him to the view expressed by Williams, viz., that the most convenient way to place hornblende crystals in order to show their relations to pyroxene is with the orthodome in the position of the basal plane. One of the amphiboles described is a blue variety with the pleochroism of glaucophane. It is found in a rock composed of green pyroxene and small pieces of brown hornblende, imbedded in a matrix of quartz, calcite, and minute blue and green amphibole needles. It is an alteration product of the brown hornblende and the augite, from both of which it results either directly or through the interposition of actinolite. Both the latter mineral and the blue hornblende are also found as enlargements attached to the clinopinacoidal and terminal planes of the brown hornblende and the augite. The axis of greatest elasticity of the blue hornblende is inclined 13° to 15° to the vertical cleavage, and is on the ~~same side of it as~~ ^{opposite to that} in the case of glaucophane, actinolite, etc., ~~while in common hornblende it is on the~~ ^{and} ~~opposite side,~~ ^{that} since the extinction angle is ~~here the angle~~ ^{here} included between c and the axis of least elasticity. The optical angle of the blue amphibole is large, and the absorption is $A > B > C$. A second rock in which the mineral occurs is a conglomerate, in pebbles in which the same relations exist between the hornblendes as those mentioned. A second rare variety of amphibole discovered in these rocks is of a rich chestnut-brown color, and has an extinction of 8° . It is regarded as an added growth. An emerald-green secondary augite occurs in diorite pebbles in the conglomerate above mentioned. It is an alteration product of the blue hornblende and of an unknown yellow mine r. Its axis of greatest elasticity is but slightly inclined to c . Its pleochroism is strong in green and yellow tints, and its absorption as follows: $A > B > C$. Upon comparing the properties of these minerals with those of other members of the amphiboloid group Mr. Cross is inclined to regard the chestnut-brown hornblende as closely allied to *barkevicite*, while the blue variety is either *arfvedsonite* or *riebeckite*. The green augite is considered to be *agerine* or *acmite*. Twelve diagrams exhibiting the relations of the axes of elasticity to the crystallographic axes of the different varieties of amphibole and pyroxene accompany the article. If the plane usually taken as the orthodome in hornblende and augite is made the basal plane, the relations shown by the diagrams are rendered quite simple; whereas if the usual

¹⁰ *Amer. Jour. Sci.*, May, 1890, p. 359.



orientation is accepted the relations are not apparent. The paper is important as affording strong argument for a change in the position of crystals of hornblende and augite, as also for the interesting announcement of the discovery of a secondary augite.—The parting of certain hornblende crystals from St. Lawrence County, N. Y., analogous to the basal parting of augite, has been found by Williams¹¹ to be the result of twinning along gliding planes parallel to the face usually regarded as the orthodome. Since the parting in augite takes place parallel to the basal plane, and since in parallel growths of hornblende and augite the parting in the two minerals is parallel, it is suggested that in both cases the plane parallel to which the parting takes place be taken as *oP*. The advantages of this new position lie in the correspondence between the morphological and optical properties of the two minerals.—Crystals of beautiful blue *celestite* are described by Williams¹² from the Helderberg Limestone in the western flank of Knobly Mountain, Mineral County, West Virginia. They occur in flattened lenticular pockets, partially or entirely filled with clay. The crystals, which are associated with gypsum and calcite, are found implanted on the walls of the cavities or imbedded in the clay. The celestite is pyramidal in habit in consequence of the predominance of the brachypinacoid P_4 . In some crystals these faces occur alone, when the crystals are often rounded into lenticular bodies. Other forms observed are ∞P_{∞} , $\frac{1}{2}P_{\infty}$, *oP*, P_{∞} , and ∞P . *oP* is rough and drusy, and ∞P_{∞} is vertically striated. The optical angle is $2 V_{na} = 49^\circ 54'$, and composition almost pure $SrSO_4$. The resemblance in habit between these celestites and thinolite,¹³ and their similarity with the Sangerhausen pseudomorphs that have generally been referred to gaylussite, are striking.—Becke¹⁴ has examined some highly modified *dolomite* crystals from the Binnenthal and from Scaleglia, and *magnesite* from the latter locality, and on the former has found some new rhombohedra. The dolomite from Scaleglia is marked by unsymmetrical etched figures that differ in shape from those artificially produced on this mineral. The magnesite is interesting, as it contains two orders of scalenohedra, the first forms of this kind found on the mineral. The hemihedral crystallization of calcite, siderite, and magnesite, and the tetrahedrism of dolomite are explained in accordance with the Sohncke-Wulff theory, by the fact that the latter's molecule comprises

¹¹ *Am. Jour. Sci.*, May, 1890, p. 352.

¹² *Ib.*, March, 1890, p. 183.

¹³ Dana. Bull. U. S. Geol. Survey, No. 12, 1884.

¹⁴ *Miner. u. Petrog. Mitth.*, XI., 1890, p. 223.

two metallic elements of different kinds, while in the former the metal is of but one kind. A full list of forms that have been discovered in dolomite is incorporated in the descriptive part of the paper.—Mr. Kemp¹⁵ communicates a few notes on some peculiar *calcite* crystals, and also on tourmalines, sphenes, and magnetites that have been subjected to pressure. The magnetite is striated as a result of the pressure, which has produced a parting apparently parallel to O and ∞O . The minerals were found in the vicinity of Port Henry and Mineville, N. Y. —A new analysis of Cornwall *connellite* by Penfield¹⁶ shows it to be analogous in composition to the new mineral spangolite. Its formula may be written $Cu_{15}(ClOH)_4SO_{16} + 15H_2O$. —The hexagonal tables of *eisenglimmer* in the sunstone of Tvedestrand, and in the carnallite of Strassfurt are pleochroic, according to Rinne,¹⁷ with $\omega > \epsilon$. The colors are yellow and dark brown. —As the result of several analyses Jannettaz¹⁸ concludes that oriental *turquoise* is colored by phosphate of copper, while the color of the occidental turquoise is of organic origin and due to phosphate of iron (vivianite). —The *titan-olivine* of Damour (from Pfunden, in the Tyrol), thought by Descloizeaux to be orthorhombic, has been examined optically by Lacroix,¹⁹ and found to be monoclinic. Its thin section is pleochroic in yellowish and reddish-yellow tints. It is polysynthetically twinned, and its optical angle $2V = 62^\circ 18'$. It is, therefore, intermediate in character between olivine and the minerals of the humite group. —At the lower extremities of stalactites of *nesquehonite*²⁰ pseudomorphs after *lansfordite* from Lansford, Pa., Genth and Penfield²¹ have discovered crystallographic planes which enable them to work out very satisfactorily the crystallization of the original mineral, which is found to be triclinic with $a : b : c = .5493 : 1 : .5655$. —The similarity in properties between *agalite* from northern New York and bastite seems to indicate that the former mineral is an altered enstatite.²² —Gürich²³ has recently published a list of the minerals occurring in the German possessions of Southwestern Africa. The list embraces about fifty-five species, and these are separated into groups, according as they occur

¹⁵ *Amer. Jour. Sci.*, July, 1890, p. 62.

¹⁶ *Ib.*, July, 1890, p. 83.

¹⁷ *Neues Jahrb. f. Min.*, etc., 1890, I., p. 193.

¹⁸ *Bull. Soc. Fran. d. Min.*, 1890, p. 106.

¹⁹ *Ib.*, XIII., 1890, p. 15.

²⁰ *AMERICAN NATURALIST*, April, 1889, p. 261.

²¹ *Am. Jour. Sci.*, Feb., 1890, p. 128.

²² Scheibe. *Zeits. d. Deutsch. Geol. Ges.*, 1890, XLI., p. 564.

²³ *Neues Jahrb. f. Min.*, 1890, I., p. 103.



in pegmatite or in quartz veins, in quartz lenses in schists, or imbedded in granite, mica-schist, hornblende rocks, crystallized limestones, or garnetiferous beds.—Oebbecke²⁴ describes briefly a small crystal of *arsenopyrite* from the granular limestone of Wunsiedel, in the Fichtelgebirge. Its composition is: As = 46.91; S. = 18.64; Fe = 34.31. —Mr. Diller²⁵ announces the discovery of native *gold* in calcite from near Minersville, Trinity Co., Cal., and Mr. Hersey²⁶ mentions the discovery of *arsenic* in nodular masses in a silver and gold mine a few miles west of Leadville, Colorado.—*Magnetite* crystals from serpentine in New Zealand are reported by Prof. Chester²⁷ to have the composition following:

Fe ₂ O ₃	FeO	Mn ₂ O ₄	MgO	CaO	SiO ₂
66.71	19.62	4.63	7.15	tr.	2.38

The silica is supposed to come from particles of silica adhering to the crystals.—Lacroix²⁸ believes that *carphosiderite* is a much more common mineral than is generally supposed.

Mineral Syntheses.—By an interesting series of experiments, that are in the main but modifications of well-known processes, Weinschenck²⁹ has prepared metallic sulphides with many of the properties of the natural compounds. By distillation of the oxides with sal-ammoniac and sulphur he obtained crystals of pyrite and of a regular copper sulphide with the composition of chalcocite. By the action of sulphuretted hydrogen under pressure upon the proper salts, galena, argentite, covellite, cinnabar, orpiment, troilite, millerite, and alabandite were produced. Corundum, diaspore, and rhodochrosite were obtained by the action of urea upon suitable compounds in solution. Other experiments afford an insight into the method of formation of the minerals of the apatite group. The paper is a valuable contribution to the study of the genesis of some of the most important of the common minerals.—Messrs. Hautefeuille and Perry³⁰ have dissolved alumina in nepheline, and have gotten a vitreous paste in which are many hexagonal plates of corundum.—Michel³¹ has produced

²⁴ *Zeits. f. Kryst., etc.*, XVII., 1890, p. 384.

²⁵ *Am. Jour. Sci.*, Feb., 1890, p. 160.

²⁶ *Ib.*, p. 161.

²⁷ *Min. Mag.*, 1889, VIII., p. 125.

²⁸ *Bull. Soc. Franc. d. Min.*, Jan., 1890, p. 8.

²⁹ *Zeits. f. Kryst.*, XVII., 1890, p. 486.

³⁰ *Bull. Soc. Franc. d. Min.*, 1890, XIII., p. 147.

³¹ *Ib.*, p. 139.

azurite and gerhardite by allowing a solution of nitrate of copper to act on particles of calcite several years under the ordinary pressure. —Nepheline, leucite and orthoclase have been obtained by Messrs. C. and G. Friedel³² upon treating finely-powdered muscovite with alkalies and alkaline silicates in various proportions. With potash containing about two per cent. of soda a portion of the muscovite is dissolved, and prismatic hexagonal crystals of nepheline are yielded. The composition of these shows them to consist of a mixture of one part of potash nepheline to two parts of the corresponding sodium compound. When soda is substituted for potash the nepheline crystals produced measure 5—8 mm. in length, and consist of one part potash nepheline to three parts of the sodium compound. When treated with silicate of potash and heated, beautiful crystals of orthoclase are produced. Leucite, together with orthoclase and nepheline, are yielded by a mixture of mica with half its weight of calcined silica and seventenths of its weight of potash. The same experimenters³³ produced anorthite by treating mica at 500° with lime in the presence of water. Having obtained sodalite³⁴ by the action of soda and sodium chloride in mica, they next attempted to make nosean by substituting the sulphate for the chloride in the last experiment, but succeeded³⁵ only in the production of prismatic negatively uniaxial crystals differing from nosean in containing two molecules of water. —Nitrate of copper heated to 130° in sealed tubes with urea yields³⁶ a basic nitrate identical with gerhardite.³⁷

³² *Ib.*, p. 129.

³³ *Ib.*, XIII., p. 233.

³⁴ *Ib.*, XIII., p. 183.

³⁵ *Ib.*, XIII., p. 238.

³⁶ Mallard. *Ib.*, p. 67. Cf. Ref. to Michel's Syntheses above.

³⁷ Wells and Penfield. *Amer. Jour. Sci.*, 1885, XXX., p. 50.

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From the AMERICAN NATURALIST, December, 1890.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—The placing of the diabases among the intrusive rocks has for some time seemed a questionable proceeding to many petrographers. They so often occur as flows between sedimentary strata, and frequently apparently as surface flows, that it would appear more logical to place them among the effusives. Brauns² has lately described a diabase from Quotshausen in the valley of the Perf,

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² *Zeits. d. Deutsch. Geol. Ges.* XLI., 1890, p. 491.

a tributary of the upper Lahn, which on its upper surface bears flowage marks like those in modern lavas. A section from this portion of the rock-mass shows a glassy base, dotted with grains of magnetite and mottled with irregularly shaped, doubly refracting areas, without further definite characteristics. Beneath the surface the mottlings resolve themselves into fibrous lath-shaped feldspar crystals, arranged in fluidal lines and extinguishing with a somewhat undulous extinction. The mass between these appears to be homogeneous, but in polarized light it is found to possess aggregate polarization. At a distance of twenty centimetres from its surface the rock consists of well-defined feldspar laths and little grains of augite and altered ilmenite. At 60-100 cm. from this surface it is a typical diabase. The interesting features connected with the occurrence are: 1, the undoubted former existence of the rock magma as a fluid upon the surface, as indicated by the structure of its upper portion and the flowage lines marked by the feldspar crystals; 2, the existence of the typical diabase texture (hypidiomorphic-granular) of the rock at but a little distance beneath its upper surface. The lack of crystals in its upper portion shows that crystallization began only after this part of the magma had come to rest. It was during this period of rest that all the crystallization took place; hence, the author concludes, rest and gradual cooling are the conditions necessary to the assumption of the hypidiomorphic structure. Continuing the subject further, the same writer describes an occurrence of diabase in a flow at Homertshausen, in Nassau. At some distance beneath its upper surface, where crystallization went on gradually, the rock is a normal diabase with an ophitic structure, and possessing no olivine. Nearer the surface it is rich in corroded olivine, poor in augite, and it contains radially divergent feldspar crystals cemented by glass. Nearer to the periphery it is composed of glass, holding crystals of augite and varioles of the composition and structure of diabase (concretions). On the periphery it is a glass with globulites, globosphærites, etc. The minute structure of each of these phases is described in great detail, as is also the effect of the solution of limestone inclusions upon the diabase material surrounding them. In the third³ division of his paper the author announces that Rosenbusch has decided to place the diabases with the effusive rocks, and then discusses their position in the scheme with respect to other basic effusives. He shows that there is no definiteness in the distinctions between augite-porphyrite, melaphyre, basalt, and diabase. Every definition that is proposed for any one of these rocks breaks down when exam-

³ *Ib.*, p. 523.

ined critically. He proposes a classification based upon slight differences in structure and appearance, ascribed primarily to differences in the conditions under which the rocks were formed, and consequently upon their geological age. They are divided as follows:

PALÆOZOIC TO CARBON. MESOZOIC TO TERT. TERT. TO RECENT.

Granular	Diabase	Melaphyre	Basalt
Porphyritic	Diabase-porphyrity	Melaphyre-porphyrity	Basalt-porphyrity
Glassey	Diabase-glass	Melaphyre-glass	Basalt-glass

It is also suggested that further definiteness might be obtained by prefixing the name of the characteristic phenocryst to the second portion of the name of the porphyrites, and to the first part the name of the characteristic mineral not porphyritically developed. Thus olivine-diabase-augite-porphyrity is an olivine diabase containing porphyritic crystals of augite.—Of the two theories proposed for the explanation of the variolite of Durance, the one regards the rock containing the peculiar structure as related in some way to gabbro, the other looks upon it as an endomorphous contact product of diabase. Mr. Cole⁴ has examined the field relations of the rock, and has come to the conclusion that the variolite is a devitrification product of a spherulitic tachylite occurring occasionally on the sides of diabase dykes, but more frequently on the surfaces of lava flows. According to this view variolite stands in the same relation to the basic lavas as pyromeride does to those of acid character. The author compares the conditions yielding the variolites with those surrounding the Hawaiian lavas. Incidentally he mentions that gabbro is not as abundant a surface rock in the vicinity of Mt. Genève as has heretofore been supposed. The serpentines of the region he regards as having been derived from some more basic rock than this. The age of the diabases and the associated variolites is supposed to be Postcarboniferous.—Compound spherulites consisting of groups of small spherulites occur in a black obsidian at Hot Springs, in California. The compound body is marked by a divergent structure, which is due to a secondary crystallization set up in the rock after the small spherulites had accumulated at given points to form the compound body. The radiating substance is thought by Mr. Rutley⁵ to be orthoclase, crystals of which run uninterruptedly through the smaller spherulites. Mr. Rutley supposes the primitive spherulites to have been formed in the obsidian while it was still

⁴ *Quar. Jour. Geol. Soc.*, May, 1890, p. 295.

⁵ *Ib.*, Aug., 1890, p. 423.

liquid, and then to have floated around until they aggregated. After the formation of these accumulations they began to crystallize, and this produced the radiating structure. Mr. Iddings, who has also seen the specimens, regards the radiating structure as original and the spherulitic structure as secondary. The bodies, he thinks, are lithophysæ, and not spherulites.—The hornblende-bearing rocks of the Prussian Graftschaft Glantz have been divided into two groups,—the first comprising eruptive syenites, and the second including hornblende schists. Traube⁶ believes that the rocks of both groups are but facies of the same mass, but whether eruptive in origin or belonging to the crystalline schist series he is unable to decide. Both the so-called syenites and the hornblende schists consist of orthoclase, quartz, mica, and augite, together with hornblende derived from it. The amount of the hornblende present (all of which is secondary) and of the other constituents varies so widely that intermediate varieties between the two types are quite common. The rock in all cases is an augite-gneiss or a quartz-bearing augite-mica-syenite. From the nature of certain phenomena observed in limestone in contact with the hornblende rocks it is thought possible that these latter are eruptive.—In a very short communication Dr. Hobbs⁷ gives an account of the alteration of gabbro into hornblende-gneiss through gabbro-diorite at Ilchester, Md. The change from gabbro into gabbro-diorite is similar in its essentials to that described by Williams in the Baltimore area. The change into gneiss is effected through the granulation of feldspår, the fraying-out of hornblende, and the production of epidote and quartz.—Pilot Knob, a hill seven miles southwest of Austin, Texas, is regarded by Prof. Hill as a Cretaceous volcano. Its material, according to Mr. Kemp,⁸ consists of nepheline-basalt, with phenocrysts of olivine and augite in a ground-mass of microlites of augite and grains of magnetite in a nepheline-glass.

Mineralogical News.—*New Minerals.*—Rammelsberg⁹ has discovered associated with the eudialyte of Sigterö, near Brevig, in Norway, a new feldspar, which he calls *sigterite*. It has the cleavage of orthoclase. Its extinction against the edge $oP \wedge \infty P_{\infty}$ is 16° . On oP two sets of twinning lamellæ make with each other angles of 7° – 9° . The extinction of each individual is therefore $3\frac{1}{2}^{\circ}$ – $4\frac{1}{2}^{\circ}$. An analysis, corrected for impurities, gave: $SiO_2=50.27$; $Al_2O_3=$

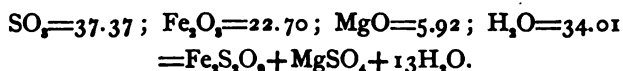
⁶ *Neues. Jahrb. f. Min., etc.*, 1890, I., p. 95.

⁷ *Trans. Wis. Acad. Sci., etc.*, VIII., p. 155.

⁸ *Amer. Geol.*, Nov., 1890, p. 292.

⁹ *Neues. Jahrb. f. Min., etc.*, 1890, II., p. 71.

30.75; $\text{Na}_2\text{O}=14.24$; $\text{K}_2\text{O}=4.73$. This corresponds to $(\text{NaK})_2\text{Al}_2\text{Si}_2\text{O}_{10}$, which according to the Rammelsberg view is $(\text{NaK})_2\text{Al}_2(\text{SiO}_3)_4 + (\text{NaK})_2\text{Al}_2(\text{SiO}_3)_2$. By doubling the formula it becomes a combination of albite and an alkaline anorthite, with nearly the composition of anhydrous natrolite. The new mineral is, consequently, a very basic alkaline feldspar, related to albite as follows: Albite $= \text{R}_2\text{Al}_2\text{Si}_2\text{O}_{10}$; sigterite $= \text{R}_2\text{Al}_2\text{Si}_2\text{O}_{10}$.—*Quetedita*, from the Salvador mine in Quetena, Chili, is a reddish-brown, translucent to opaque mineral, with a slightly waxy lustre. Its hardness is 3, and density 2.08–2.14. It occurs¹⁰ massive, associated with copper vitriol, and in prismatic monoclinic or triclinic crystals in the latter mineral. Its analysis gave:



—*Gordaite* accompanies sideronatrite from Sierra Gorda, near Caracoles, in Chili, as one of a number of thin coatings covering this mineral.¹⁰ It is glassy, transparent, and forms short, broadly-tabular pieces and crystals, or fibrous masses of a white to light gray color. Its hardness is 2.5–3, and specific gravity 2.61. The crystals are triclinic prisms with their lateral faces vertically striated. The mineral forms the end member of a series of hydrous iron-sodium sulphates, of which sideronatrite, with but a small proportion of sodium, is the other end member. The composition of gordaite ($\text{SO}_3=50.85$; $\text{Fe}_2\text{O}_3=19.42$; $\text{Na}_2\text{O}=22.36$; $\text{H}_2\text{O}=7.33$) corresponds to $\text{Fe}_2\text{S}_2\text{O}_8 + 3\text{Na}_2\text{SO}_4 + 3\text{H}_2\text{O}$.—*Tamarugite*, from Tarapaca, Chili, is described by Schultze¹¹ as a massive, colorless, radiated mineral, with a hardness of 2, and a density of 2.03. In composition it differs from soda alum in its percentage of water, as indicated by the formula $\text{Na}_2\text{SO}_4 + \text{Al}_2(\text{SO}_4)_3 + 12\text{H}_2\text{O}$.—*Ciplite* is a phosilicate of calcium occurring in the chalk of Ciply, in France.¹²

General.—Up to the temperature of 570° quartz crystals expand rapidly, both parallel and perpendicular to the vertical axis, and at this temperature become fissured. Above this temperature quartz expands very slightly, in some cases even appearing to contract.¹³ Between 560° and 580° sections perpendicular to c become doubly refractive. The double refraction increases rapidly below 570° , and above this

¹⁰ Frenzel. *Min. u. Petrog. Mittheil.*, 1890, XI., p. 217.

¹¹ Verh. d. Ver. Santiago, 1889. Ref. *Neues Jahrb. f. Min.*, etc, 1890, I., 258.

¹² Ortiler: *Ann. Soc. géol. du Nord.*, XVI., 1888–89, p. 270. Ref. *Bull. Soc. Franc. d. Min.*, 1890, XIII., p. 160.

¹³ Le Chatelier. *Bull. Soc. Franc. d. Min.*, 1890, p. 112.

temperature remains nearly constant. The birefringence¹⁴ is also subjected to a sudden change at this temperature. Other experiments to be made in this same line will undoubtedly show that 570° is a critical temperature for the mineral, above which it loses its characteristic properties.—Cleavages parallel to R and —R, and less perfect ones parallel to ∞P and oP, have been detected by Mallard¹⁵ in thin plates of quartz. The discovery confirms the suspicion that the mineral possesses obscure cleavages, usually noticeable only when fragments of it are heated and plunged into cold water.—In an article in a recent Bulletin of the U. S. Geological Survey, Mr. Hillebrand¹⁷ gives the results of analyses of some rare zirconium minerals found in the granitic debris of Devil's Head Mountain, Douglas Co., Colo. He also records the analysis of a white *beryl* from the gangue of a cassiterite vein at Winslow, Me. The composition of the beryl is:

SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	BeO	MgO	(KCs) ₂ O	Na ₂ O	Li ₂ O
65.21	tr.	18.50	.33	13.03	.09	.14	.87	.16
H ₂ O Sp. Gr.								
1.80 2.707								

—Although specimens of *tyrolite* recently obtained at the Mammoth Mine, Utah, are sufficiently well crystallized to afford Prof. E. S. Dana¹⁸ data for the determination of the ratio between their lateral axes, it has not been possible to decide upon their chemical composition. The crystals are in flat tables, united into fan-like groups. They are orthorhombic, with their optical axes in the brachypinacoid. Their double refraction is negative and $a:b=.9325:1$. An analysis by Mr. Hillebrand yielded:

CuO	CaO	As ₂ O ₃	H ₂ O	SO ₂	Fe ₂ O ₃	Ins.
45.08	6.78	28.52	17.21	2.23	.08	.16

But this is not capable of representation by a rational formula.—The characteristics of *polycrase* have been defined with some accuracy by Messrs. Hidden and Mackintosh.¹⁹ The material investigated was obtained in the zircon region in Henderson Co., N. C., and from the Upper Saluda River, S. C. The mineral occurs in rough crystals bounded by ∞P₃, P_∞, 2P_∞, P₃, and $\frac{1}{3}$ P_∞, the latter new to the

¹⁴ *Ib.*, p. 119.

¹⁵ *Ib.*, p. 123.

¹⁶ *Ib.*, p. 61.

¹⁷ Bull. No. 55, pp. 48–55.

¹⁸ *Amer. Jour. Sci.*, Apr., 1890, p. 271.

¹⁹ *Amer. Jour. Sci.*, Apr., 1890, p. 302.

species. It is black on a fresh fracture, and has a brownish-yellow translucency on thin edges. It has a density of 4.925-5.038, a hardness of 5.5, and a light yellowish-brown streak. On exposed surfaces it alters to a lemon-yellow *gummite*, with a density 3.354, and hardness 3.5. An analysis of the crystals from South Carolina gave:

Cb_2O_5	Ta_2O_5	TiO_2	Y_2O_3 etc.	PbO	FeO	Fe_2O_3	UO_3	CaO	H_2O
47.88	21.23	.46	2.47	.18	19.47	.68	4.46		

Ins.	SiO_2	F
.12	1.01	und.

The authors call attention to the fact that the mineral is the first representative of the columbo-titanates in America.—The rare mineral *eukairite* has been found in Villa Argentina, Prov. Rioja, Argentine, and at several localities in the Andes, associated with calcite, bornite, and other sulphides of copper. It crystallizes in cubic forms (not necessarily regularly), and has a density of 7.641-7.661, and a composition, according to Otto,²⁰ as follows: $\text{Ag} = 42.7$; $\text{Cu} = 25.5$; $\text{Se} = 31.5$. In general appearance it is like galena.—Lacroix²¹ describes the optical properties of quite a number of *crocidolites*, and concludes that the mineral is a variety of hornblende very widely spread through rocks of various kinds. It may be distinguished from glaucophane by its positive double refraction on basal sections, and its negative refraction in elongated sections.—After analyzing a large suite of *wads* and *psilomelanes*, Gorgeu²² is inclined to regard them as manganites of various bases, corresponding approximately to the formulas $3(\text{MnO}_2)\text{RO} + 1-3\text{H}_2\text{O}$. Among the wads examined were a few quite well crystallized.—Four crystals of *orthoclase* from the porphyritic granite of the Fichtelgebirg are described by Müller²³ as interpenetration twins, in which each individual is elongated in the direction of its α axis. Their oP faces are in the same plane, so that their combination is \times -shaped, with the twinning plane a hemi-pyramid.—Laspeyres²⁴ suggests that the ground-form of *biotite* be made to correspond with that of *clinochlore*, so that the isomorphism of the two minerals may be made more apparent.—Messrs. Clarke and Schneider²⁵ have shown experimentally that the *talc* from Hunter's Mill, Fairfax Co.,

²⁰ Ber. d. deutsch. chem. Ges., XXIII., 1890, p. 1039.

²¹ Bull. Soc. Fran. d. Min., 1890, p. 15.

²² Ib., p. 21.

²³ Zeits. f. Kryst., XVII., 1890, p. 484.

²⁴ Zeits. f. Kryst., XVII., p. 541.

²⁵ Ber. d. deutsch. chem. Ges., XXIII., p. 1537.

Va., comports itself more like a meta-silicate than like a basic pyrosilicate. They therefore decide against Groth's formula for this mineral, and propose instead the formula $H_2Mg_3(SiO_3)_4$.—Crystals of sulphur containing twenty-one forms line clefts in galena at Bassick. Their axial ratio is $a:b:c = .8151:1:1.9066$. Busz,²⁶ who describes these sulphur crystals, describes also in the same article a *beryl* crystal from St. Piero, Elba, *fluorspar* and *göthite* from Cornwall, *hypersthene* from Monte Doré, and *corundum* from Lake Laach.—*Bucklandite* from the Pfischthal, Tyrol, and *epidote* crystals from Oberhollersbachthal in Pinzgau, and from Floss in Bavaria, have been examined crystallographically by Brugnatelli.²⁷—*Pyrophyllite* occurring in a granite dyke at Finibo in Sweden, *augite* from Risoe in Sweden, and *martite* from an iron mine in Ypanema, São Paulo Province in Brazil, have been briefly described by Kenngott.²⁸—The composition of *arsenopyrite*,²⁹ from Goldkronach and from Neusorg in the Fechtelgebirge is:

	S	As	Sb	Fe	Ni	Co	Ag	Sp. Gr.
Goldk.	20.84	41.36	3.73	34.07			.002	6.09
Neusorg.	17.27	42.89		34.64	4.38	tr.		5.96

—*Chalcocite*³⁰ from the Kathrina mine near Innsbach, in the Bavarian Pfalz, contains:

Cu	Fe	As	S	Co and Ag	Sp. Gr.
78.44	.93	1.22	20.13	tr.	5.68

—*Minium* from Leadville, thought by Mr. Hawkins³¹ to be a pseudomorph after galena, has been examined with the following result:

Pb ₂ O ₄	Fe ₂ O ₃	V ₂ O ₅	Insol.	Sp. Gr.	Hardness.
91.39	.80	.52	7.51	4.57	2.5

—Mr. Seamon³¹ thinks that the *calamine* of Missouri was produced by segregation from zinciferous clays formed by the reaction between zinc sulphide and hot silicious waters.—Baumhaur's³² recent investigations on *apatite* crystals from various localities affirm the statement that the density and axial ratio of this mineral increase with the decrease of chlorine in its composition.—In a short communication

²⁶ *Zeits. f. Kryst.*, XVII., p. 549.

²⁷ *Ib.*, XVII., p. 529.

²⁸ *Neues Jahrb. f. Min.*, etc., 1890, I., p. 87.

²⁹ Sandberger. *Ib.*, 1890, p. 99.

³⁰ *Amer. Jour. Sci.*, Jan., 1890, p. 42.

³¹ *Ib.*, 1890, p. 39.

³² *Zeits. f. Kryst.*, XVIII., 1890, p. 31.

Miers³³ shows that *stephanite* is not hemihedral, but that its crystals are usually twinned hemimorphic forms.—Brief descriptions of *cerussite*, *anglesite*, and *calcite* crystals from the Diepenlinchen Mine, near Stolberg, are given by Dannenberg.³⁴—*Phenacite* and *topaz*, the latter altering into *damourite*, occur at Amelia Court House, Va. On the former mineral from Hebron, Me., Mr. Yeates³⁵ has discovered the basal plane.—Prof. Dana³⁶ finds that the barium sulphate from Perkin's Mills, Templeton, Can., described by Lacroix as a monoclinic dimorph of barite under the name *michel-levyite*, is really orthorhombic, and therefore true *barite*, and that the peculiar striations observed on it are probably due to pressure.—Minute crystals of *jarosite* line cavities in a siliceous *limonite* at the Mammoth Mine, Utah.³⁷—*Thenardite*, *glauberite*, and *calcium carbonate* pseudomorphs of the last-named mineral form thick deposits in a lake-like depression in the Verde Valley, Ariz. Mr. Blake,³⁸ to whom we owe this knowledge, mentions also the existence of *bourbonite* at the Bogg's Mine, Yavapai (?) Co., in the same State.—Heddle³⁹ declares that *brinachite* of Wallace,⁴⁰ occurring in veins in a conglomerate in Inverneshire, is fluorite.—The same author⁴¹ has made a very superficial examination of two crystals of *gyrolite* from the Freshinish Islands, near Mull, England, and pronounces them probably monoclinic.—Solly records his measurements of *struvite* crystals formed by micro-organisms in gelatine culture tubes.

Miscellaneous.—Messrs. Gattermann and Ritschke,⁴² in their work on Azoxyphenolether, have obtained a substance which they call anisolazoxyphenetol. This substance, though liquid, appears to possess many of the characteristics of crystals. Its drops are doubly refractive and dichroic.—In a very interesting communication Rinne⁴³ shows that the oxides of the metals are isomorphous with their corresponding sulphides, a view that is in perfect harmony with the chemical relations existing between oxygen and sulphur. The minerals thus thought to be isomorphous are zincite and wurtzite, valentinite and

³³ *Ib.*, XVIII., p. 68.

³⁴ *Ib.*, XVIII., p. 64.

³⁵ *Amer. Jour. Sci.*, Apr., 1890, p. 325.

³⁶ *Amer. Jour. Sci.*, Jan., 1890, p. 61.

³⁷ *Genth. Ib.*, p. 73.

³⁸ *Ib.*, 1890, p. 43.

³⁹ *Miner. Mag.*, Oct. 1889, p. 272.

⁴⁰ *Ib.*, 1887, p. 42.

⁴¹ *Ib.*, 1889, p. 279.

⁴² *Ber. d. deutsch. chem. Ges.*, 1890, p. 1738.

⁴³ *Zeits. d. deutsch. geol. Ges.*, XLII., 1890, p. 62.

stibnite, manufactured bismuth oxide and bismuthinite. The following groups are also thought to be isomorphous, since they occur in isomorphous compounds: CdO and CdS, MnO and MnS, and FeO and FeS.—Mr. Dudley⁴⁴ describes pseudomorphs of vivianite after roots of coniferous plants, from the clay banks of the Cumberland River, ten miles above Eddyville, Ky.—In a short note Wulff⁴⁵ suggests a method by which plane angles may be measured under the microscope when the apex of the angle cannot be seen, and when its two sides cannot be brought into the field of view at once.—Mr. Brönnel,⁴⁶ of the firm of Voight & Hochgesang, has invented a heating apparatus, attachable to any microscope, for use in mineralogical investigations.

New Books, etc.—The ninth annual report of the State Mineralogist of California contains statistics of the mineral products of the State for the year 1889, and accounts of the geology of the mining districts.⁴⁷—The Mineral Resources⁴⁸ of the United States for 1888, though late in appearing, is as welcome an addition to mineralogical literature as any of its predecessors have been. The wealth of information within the 630 pages of the present volume defies abstraction. The value of the metallic products of the country for the year in review exceeded the value of those mined in 1887 by about six millions of dollars; while the non-metallic products were larger by seventy-two millions than those of the preceding year. The totals for 1888 are: Metallic products, \$256,257,517; non-metallic products, \$322,293,159; unspecified, \$6,000,000; grand total, \$584,550,676. Of especial scientific interest is the description of the occurrence and association of the tin ore of the Black Hills, Dak.—The third part of Hintze's Mineralogy,⁴⁹ which has but recently appeared, concludes the tourmaline group of minerals and takes up the humite, helvine, melanocerite, and other groups of rare silicates, as well as diopside, staurolite, bementite, prehnite, and individual minerals of less common occurrence.

⁴⁴ *Am. Jour. Sci.*, Aug., 1890, p. 120.

⁴⁵ *Zeits. f. Kryst.*, XVIII., p. 277.

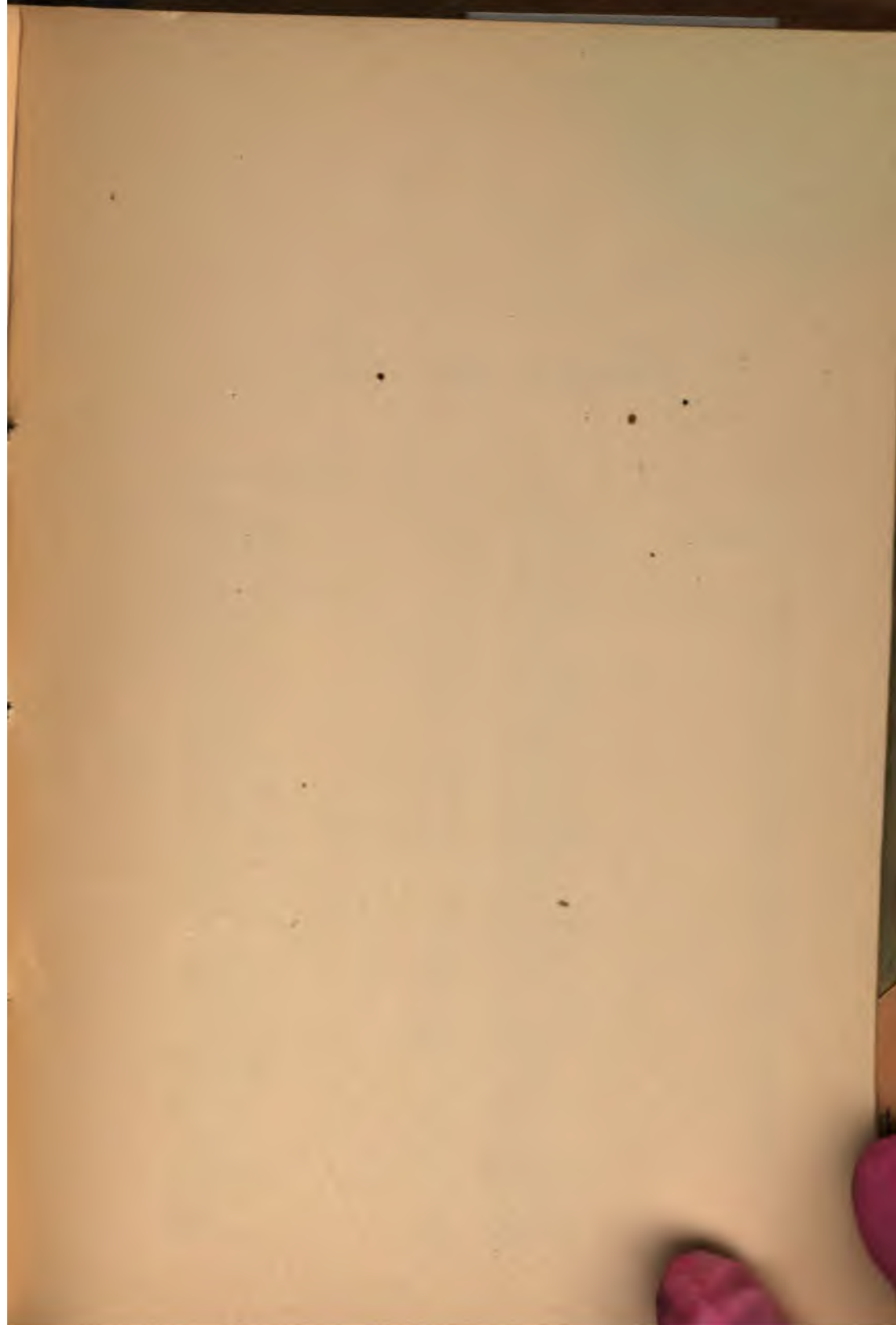
⁴⁶ *Neues Jahrb. f. Min.*, etc., 1890, II., p. 87.

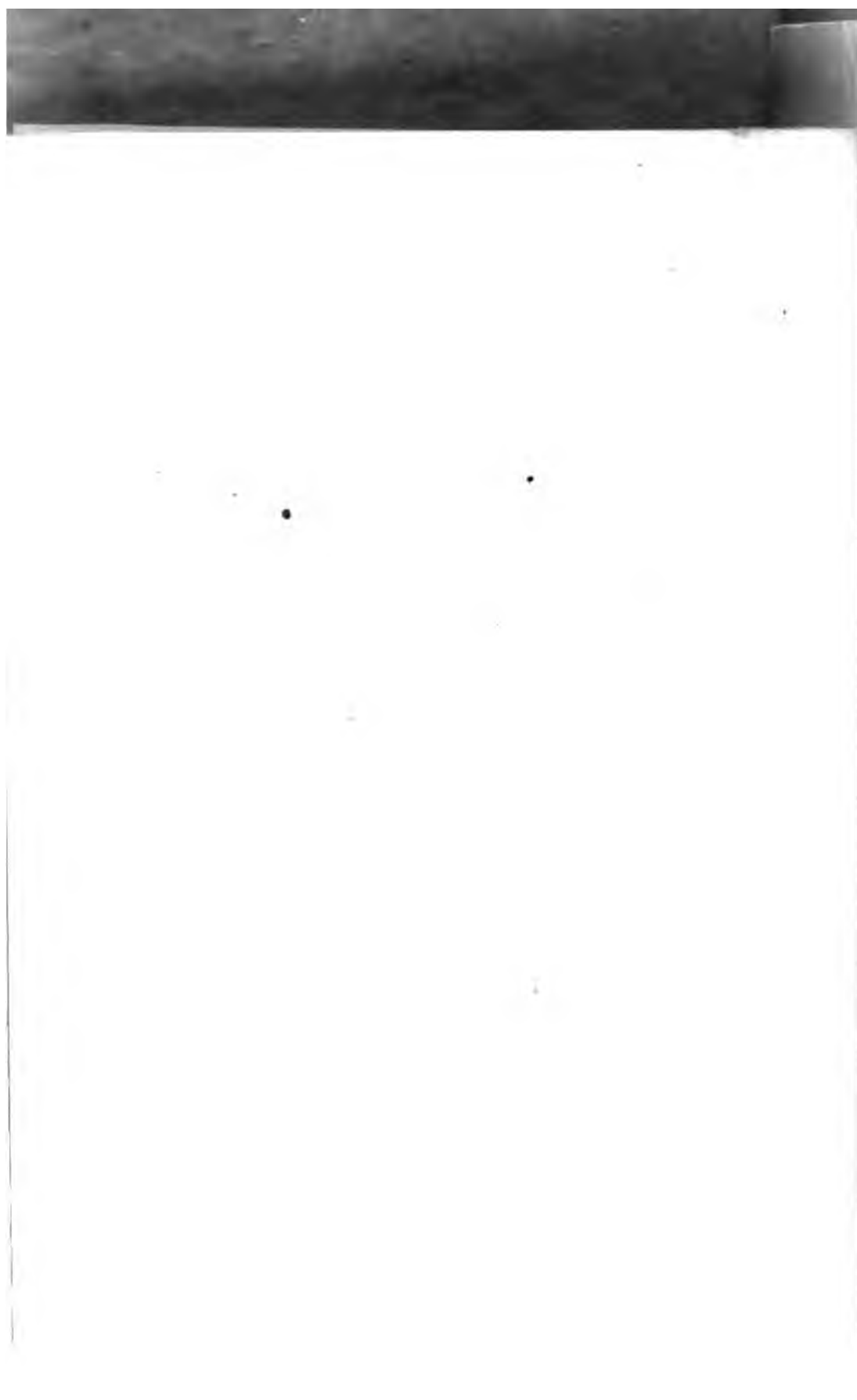
⁴⁷ Wm. Ireland. Ninth Ann. Rep. of the State Mineralogist for 1889. Cal. State Miner. Bureau, Sacramento, Cal.

⁴⁸ D. T. Day. Mineral Resources of the United States for 1888. Washington Govt. Print. Office, 1890.

⁴⁹ Leipzig. Veit & Co., 1890, pp. 321-480, 79 Fig.

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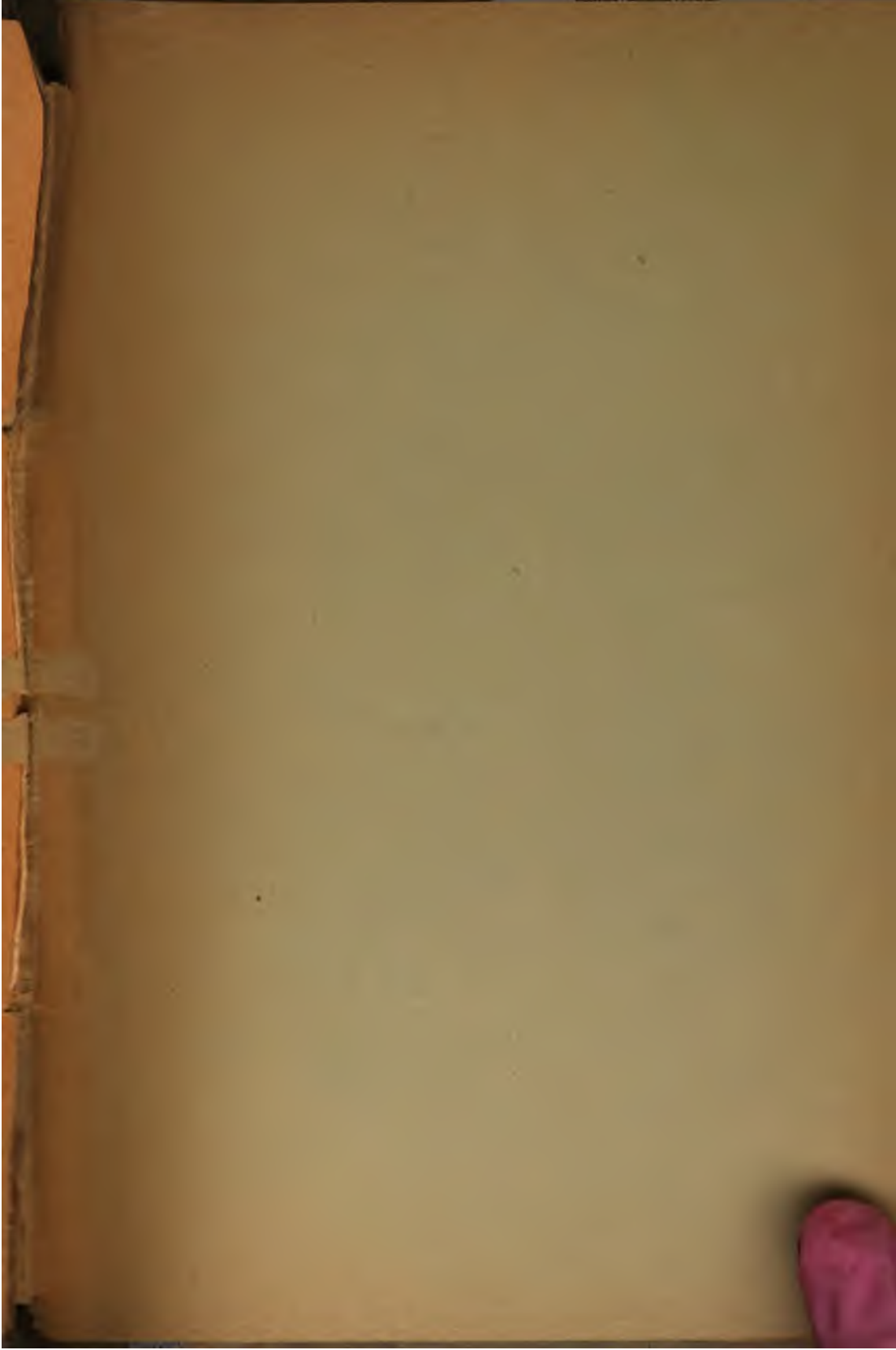
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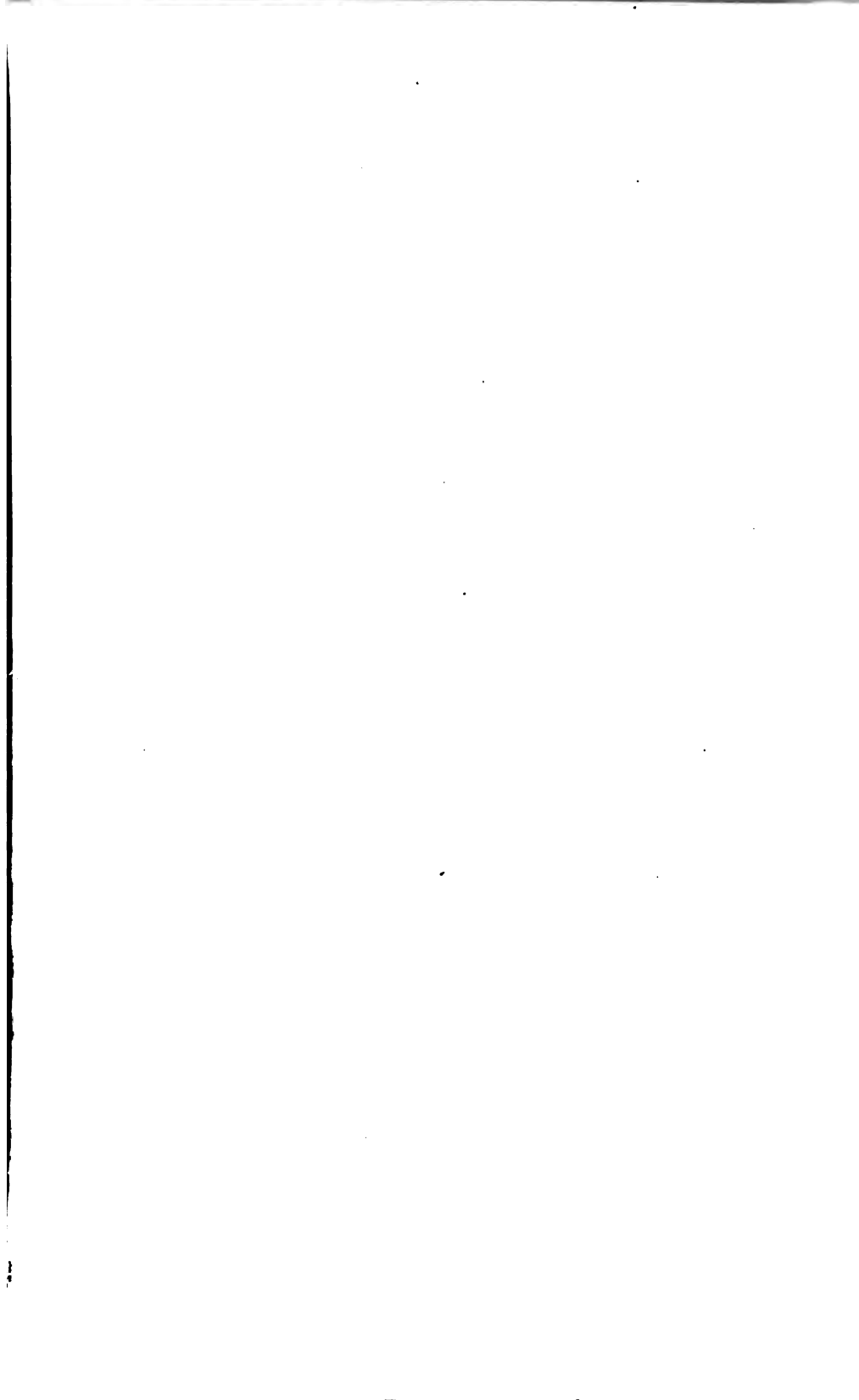
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GALFORD WHOLE
NEW YORK
STATIONER & PRINTER
100 N. 3RD ST.
NEW YORK, N.Y.

Printed and Published by J. H. Galt





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